NOVEMBER 1960

Heating Piping & Air Conditioning

... for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

ENGINEERING DATA FILE
What to Consider When Designing Nuclear Piping Systems ... page 153

Contents .... page 5
Letter from the Editor ...... page 11
You'll Want to Know ...... page 39
"Open for Discussion" ..... page 99
Question of the Month ..... page 104

One Power Piping Design ▸▸▸ Serves Central Station Four Times ... page 109

Steam, Hot Water, Warm Air Used at 4-Building Research Center ... page 114

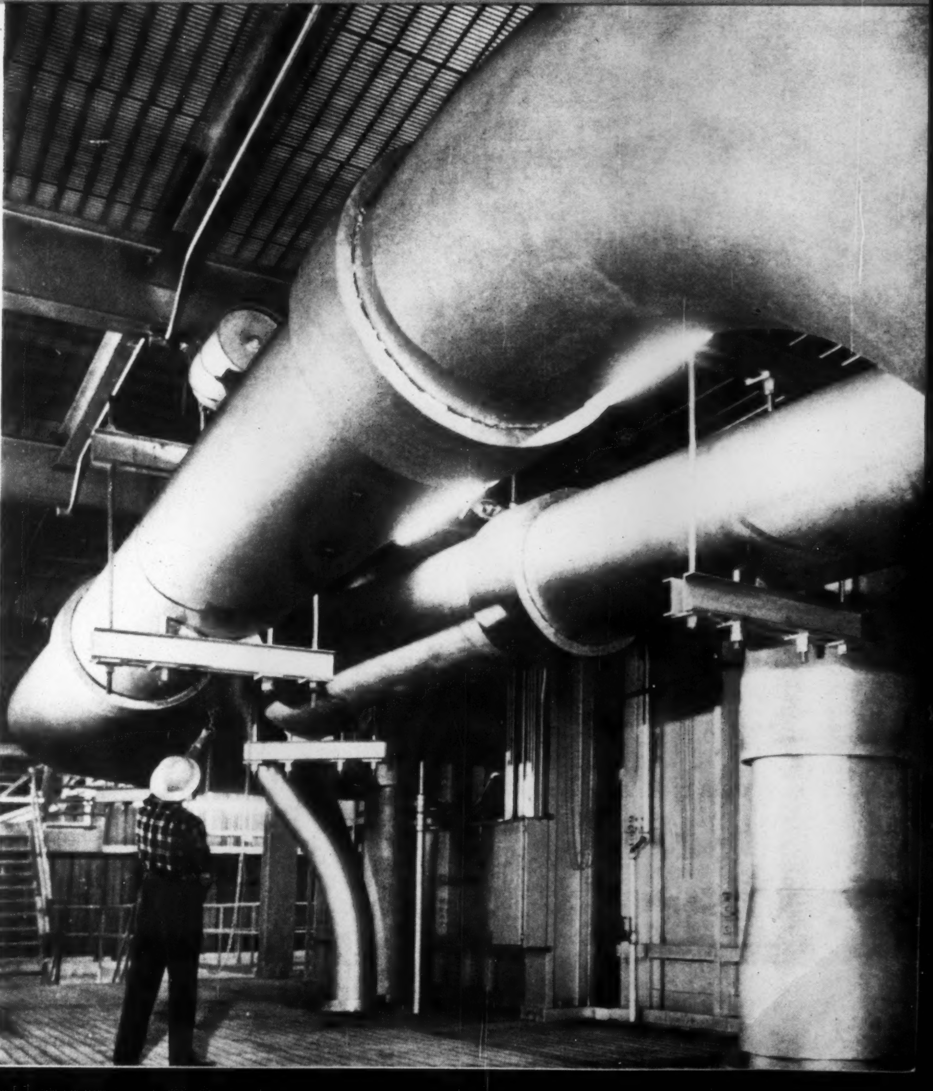
Solar Air Conditioning Tested for Performance, Practicality ... page 120

New Bidding Plan Suggested By Mechanical Contracting Group ... page 129

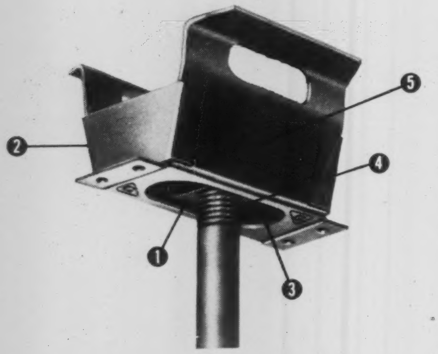
Infrared Comfort Heating — What Do We Know About It? ... page 133

Match Process Piping Pump Needs With Available Bronze Alloys ... page 145

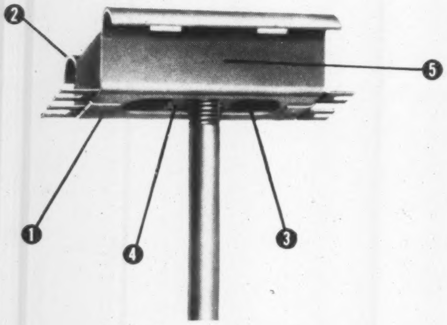
Good Water Treatment Saves Air Conditioning Dollars ... page 151



See all the extra features you get in Grinnell Concrete Inserts...at no extra cost!



GRINNELL WEDGE TYPE CONCRETE INSERT (Steel), FIG. 281 — 1. Nut and rod may be preassembled for fast installation 2. Wedge-shaped body compresses in concrete for extra strength 3. Knockout (already removed) seals out concrete 4. Full 1¾ inch lateral adjustment 5. Supports up to 1200 lbs.



GRINNELL LIGHT WEIGHT CONCRETE INSERT (Steel), FIG. 285 — 1. Designed for light-duty use in concrete 2 inches and thicker 2. Arched flanges take reinforcing rods 3. Knockout seals out concrete 4. Full 2 inch lateral adjustment 5. Supports up to 400 lbs.

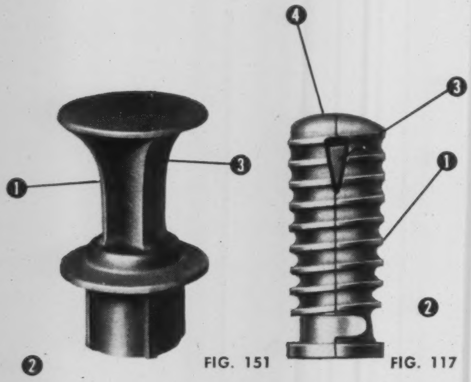
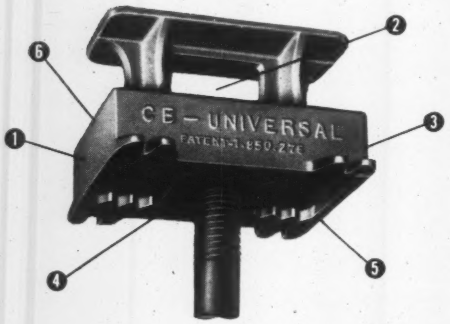


FIG. 151

FIG. 117

GRINNELL SCREW CONCRETE INSERT (Malleable Iron), FIG. 151 — 1. Malleable iron for extra strength 2. Pipe sizes through 12 inches. 3. Supports up to 2,120 lbs. **GRINNELL EXPANSION CASE (Malleable Iron), FIG. 117** — 1. Malleable iron, cadmium plated, assures high resistance to impact, corrosion 2. Pipe sizes through 16 inches 3. Rod moving upward forces wedge-shaped nut downward, expanding and locking case in concrete 4. Supports up to 1300 lbs.



GRINNELL CB "Closed Back" CONCRETE INSERT (Malleable Iron), FIG. 282 — 1. One body size accommodates 5 sizes of rods 2. Slot takes reinforcing rods to assure maximum load rating. 3. One-piece body prevents concrete seepage 4. Teeth on insert and nut hold rod firmly in place 5. Homogeneous composition of malleable iron throughout 6. Supports up to 1430 lbs. (Also available in smaller "CB-JUNIOR" size that supports up to 770 lbs.)

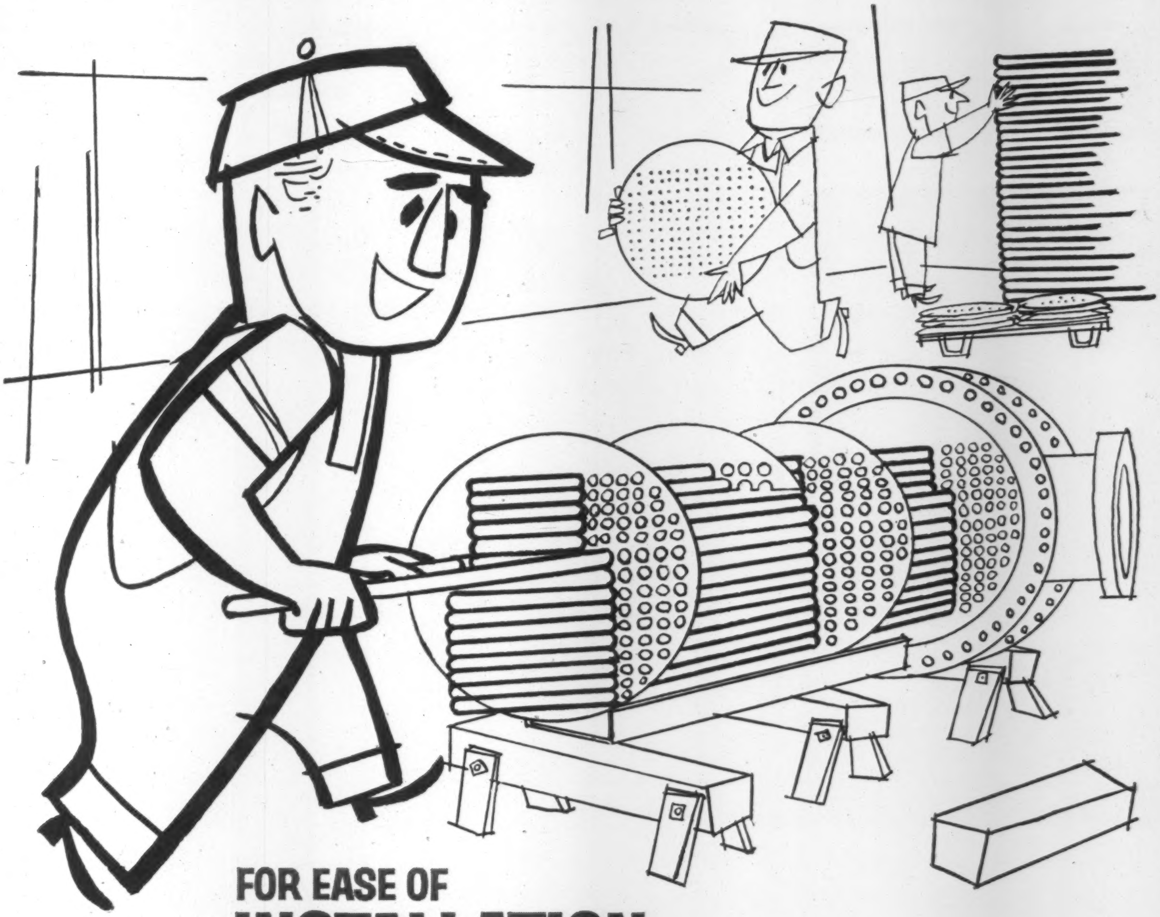
You get *more* for your money from Grinnell, because Grinnell's huge volume reduces production costs . . . lowers prices right into line with competitive inserts offering much less.

Look at all you get with Grinnell Inserts: wider choices of types and sizes . . . better quality control . . . published ratings for *all* inserts! Faster delivery from nationwide warehouses, too. Moreover, you receive dependable field service by trained Grinnell personnel . . . no matter how far from the job site the sale was made! Grinnell Company, 277 West Exchange St., Providence 1, R. I. Branch warehouses in principal cities.

Remember, The Best Costs No More — from America's #1 Supplier of Pipe Hangers and Supports

Call your local Grinnell Distributor for pipe hangers, cast and malleable iron fittings, steel nipples, welding fittings, Grinnell-Saunders Valves, unit heaters – all made by

GRINNELL



FOR EASE OF
INSTALLATION AND LONG SERVICE LIFE
SPECIFY

B&W *Job-Matched*
Lectrosonic steel heat exchanger tubing

With B&W LECTROSONIC you get . . .

- an electric-resistance-welded carbon steel heat exchanger tube manufactured to ASTM-ASME standards under a rigid system of quality control and proven by five years of extensive field service
- a dimensionally accurate heat exchanger tube that fits properly into tube sheets and threads easily through baffles
- a welded tube with a new concept of quality, designed specifically for economical long life in heat exchangers

B&W Job-Matched LECTROSONIC Heat Exchanger Tubing is available through a nationwide network of district sales offices and Steel Service Centers. And remember—matching tubes to jobs assures you the *right tube,* in the *right quantity,* at the *right time.* For more information, call your local B&W District Sales Office, or write for Bulletin T-431. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

Steel

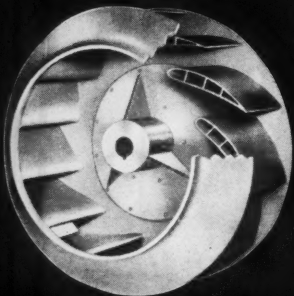
B&W THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

TA-9058-WP

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

DESIGN 10



Newest airfoil fan achievement

"Chicago's" totally new line of AMCA rated Airfoil Bladed Fans now offers even more than the parent line that revolutionized the industry 8 years ago . . . LOWER SPEEDS THAN BEFORE . . . QUIETER THAN BEFORE . . . WIDER SELECTION RANGE THAN BEFORE.

NEW SPECIFICATION BULLETIN A-104 simplifies fan selection for high velocity or conventional ventilation in air supply or exhaust, industrial processing or mechanical draft applications. Performance tables are color coded to meet any operating condition . . . sizes range from 12¼ to 89 . . . air deliveries from 440 to 550,000 cfm . . . static pressures from ¼″ to 30″ . . . constructions for standard and heavy duty . . . designs for single and double inlets . . . classes range from I through V.

CERTIFIED RATINGS

Certified Ratings are the result of tests made by the manufacturer in accordance with Standard Test Codes adopted by the Air Moving and Conditioning Association, Inc. Air Moving and Conditioning Association, Inc., is successor to Industrial Unit Heater Association, National Association of Fan Manufacturers, Inc., and Power Fan Manufacturers Association.

AUTHORIZED BY AMCA

Clip coupon to your letterhead & mail for new Specification Bulletin A-104

0827

Find Your Nearest Agent In The 'Yellow Pages'

Phone your nearest "Chicago" Sales Engineer

CHICAGO
BLOWER CORPORATION
First to market Airfoil Bladed Fans

CHICAGO BLOWER CORPORATION
9869 Pacific Avenue, Franklin Park, Illinois

Send FREE SPECIFICATION GUIDE A-104 which illustrates all the advantages of Design 10 Airfoil fans and gives me all the data I need for proper fan selection

Name______________________________

Firm______________________________

Address____________________________

City__________________Zone______State______

Heating, Piping & Air Conditioning

FOR CONSULTING ENGINEERS, MECHANICAL (HEATING, PIPING, AND AIR CONDITIONING) CONTRACTORS, ENGINEERS WITH PLANTS AND BIG BUILDINGS

VOL. 32, NO. 11 NOVEMBER 1960

FEATURES

One Design Serves Four Times on Power Piping Job 109
Steam, Hot Water, Warm Air Meet Research Center's Complex Needs 114
Rewind Brake Gets "New" Cooling System 119
Tests Prove Feasibility of Solar Air Conditioning 120
Size Suction Lines for True Economy 127
Mechanical Specialty Contractors Devise New Bidding Plan 129
What Do We Know About Infrared Comfort Heating? 133
Sam Lewis Says: "Keep Up With Engineering Progress on the European Side" 142
How to Match Centrifugal Pump Needs With Available Bronze Alloys 145
Good Water Treatment Equals Dollars Saved in Large Building Air Conditioning 151

DATA SHEET

New Graph Relates Thermo-Physical Properties of Saturated Water, Steam 143

ENGINEERING DATA FILE

What to Consider When Designing Nuclear Piping Systems 153

DEPARTMENTS

Letter from the Editor 11
You'll Want to Know 39
"Open for Discussion" 99
Question of the Month 104
Equipment Developments 185
Recent Trade Literature 233
We Hear That 244
Who's What 248
Meetings and Conventions 252
New Books and Reports 254
Index to Advertisers 258

Board of Consulting and Contributing Editors .... LESTER T. AVERY, N. R. BERNZ, JOHN E. BROCK, LEO F. COLLINS, SABIN CROCKER, CARL A. DOPP, PHILIP DRINKER, M. K. FAHNESTOCK, WILLIAM GOODMAN, WILLIAM A. HANLEY, E. P. HECKEL, R. E. HIERONYMUS, JOHN A. HOLBROOK, LEE P. HYNES, C. W. KIMBALL, A. C. KIRKWOOD, CHARLES S. LEOPOLD, SAMUEL R. LEWIS, H. C. MURPHY, LESTER S. RIES, K. E. ROBINSON, F. B. ROWLEY, ROBERT P. SCHOENIJAHN, KALMAN STEINER, T. S. TENNEY, RUSH D. TOUTON, EPH A. TYLER.

Editorial Director .... C. M. BURNAM, JR.
Editor .... ROBERT W. ROOSE
Engineering Editor . DONALD R. BAHNFLETH
Associate Editor .... JAMES D. WILDER
Associate Editor .... ARTHUR R. GOLLBERG
Editorial Assistant .... MARY E. HOLLIGAN

Advertising Staff . . . . WALLACE J. OSBORN, ROBERT J. OSBORN, and RICHARD G. OSBORN, New York—Yukon 6-1450 . . . . ROBERT A. JACK, Cleveland—Superior 1-1291 .... JOHN T. HUGHES, Detroit—Greenleaf 6-2795 . . . . GEORGE C. CUTLER and THOMAS V. JOHNSON, Chicago—State 2-6916 . . . . JAMES D. THOMAS, TUCSON—East 6-3698 . . . . WETTSTEIN, NOWELL & JOHNSON, INC., Los Angeles—Dunkirk 8-2286, Portland—Capitol 8-4107, San Francisco—Yukon 2-9537.

President & General Mgr. .. CHAS. E. PRICE
Subscription Sales Mgr. .. W. W. GREGORY
Production Mgr. .... LAWRENCE A. DOYLE

Merged with Heating, Piping & Air Conditioning is the Aerologist

Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2, Ill. Telephone: STate 2-6916. Subscriptions: U.S. and possessions, $3.00 per year; Canada, $5.00 per year; Cuba, Mexico, Central America, South America, Spain, $6.00 per year; other, $7.00. Current copies, 75c each; back copies, $1.00 each. Member Audit Bureau of Circulations and Associated Business Publications, Inc. Heating, Piping & Air Conditioning is indexed regularly by Engineering Index, Inc., and Industrial Arts Index and is microfilmed by University Microfilms. ©1960 by the Keeney Publishing Co. SECOND-CLASS POSTAGE PAID AT CHICAGO AND MENDOTA, ILL.

SUBSCRIBERS—*Change of Address*: Publisher needs five weeks' advance notice, mail address from current issue envelope, and new address with city postal zone number. Mail to . . . Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill., U. S. A. POSTMASTER: *When Magazine Is Undeliverable*: Send Form 3579 to Publisher at above address. Include city postal zone AND DATE *on last line* under mail address on envelope as our *key*.

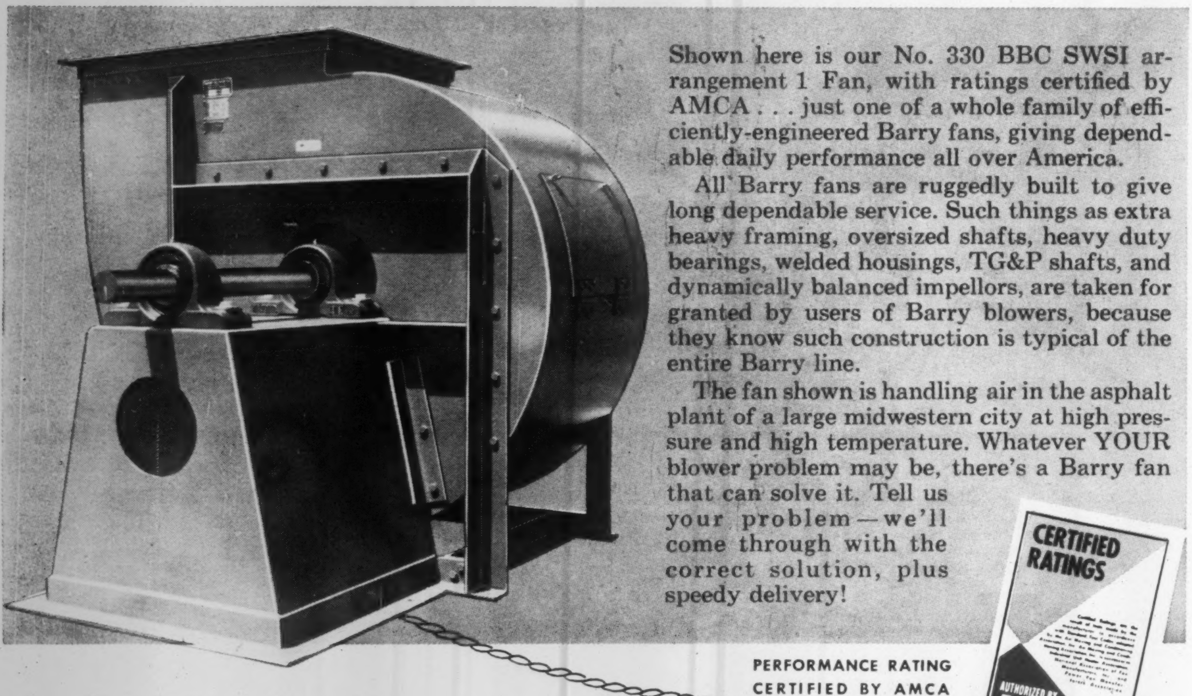
BRUTE STRENGTH
RUGGED CONSTRUCTION
SKILLED ENGINEERING

make

BARRY

Centrifugal Fans

PERFORM WITH PERFECT SATISFACTION



Shown here is our No. 330 BBC SWSI arrangement 1 Fan, with ratings certified by AMCA . . . just one of a whole family of efficiently-engineered Barry fans, giving dependable daily performance all over America.

All Barry fans are ruggedly built to give long dependable service. Such things as extra heavy framing, oversized shafts, heavy duty bearings, welded housings, TG&P shafts, and dynamically balanced impellors, are taken for granted by users of Barry blowers, because they know such construction is typical of the entire Barry line.

The fan shown is handling air in the asphalt plant of a large midwestern city at high pressure and high temperature. Whatever YOUR blower problem may be, there's a Barry fan that can solve it. Tell us your problem—we'll come through with the correct solution, plus speedy delivery!

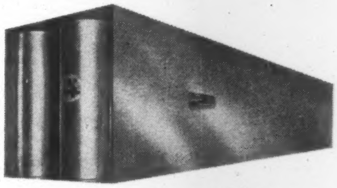
PERFORMANCE RATING CERTIFIED BY AMCA

BARRY BLOWER CO.
3100 CALIFORNIA ST. N. E., MINNEAPOLIS 18, MINN.

member of air moving and conditioning association inc.

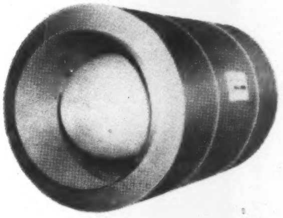
FC VENTILATING FANS • INDUCED DRAFT FANS • STEEL PLATE FANS • FAN WHEELS AND SCROLLS • BBC VENTILATION FANS • FORCED DRAFT FANS • FUME EXHAUST FANS • UTILITY EXHAUSTERS • BELTED VENTILATING SETS • MATERIAL HANDLING FANS • MEDIUM PRESSURE BLOWERS • SPECIAL APPLICATIONS your key to lower cost and higher performance*

Quiet-DUCT Silencers



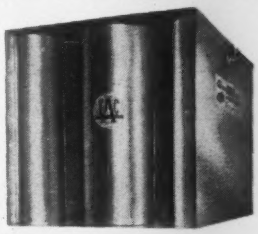
Available in 4 Standard Models —
23 Standard Unit Sizes —
2 Connection Types

Conic-Flow Silencers



Available in Lengths from 2 to 10 Feet

MOD-U-SIZE Silencers



Available in 2 Standard Models —
5 Standard Unit Sizes

Quiet-VENT Silencers

Available in 3 Types —
6 Standard Models

Quiet-VENT Silencers provide conversational privacy and freedom from disturbing noises coming through return air vents — yet permitting the free circulation of air.

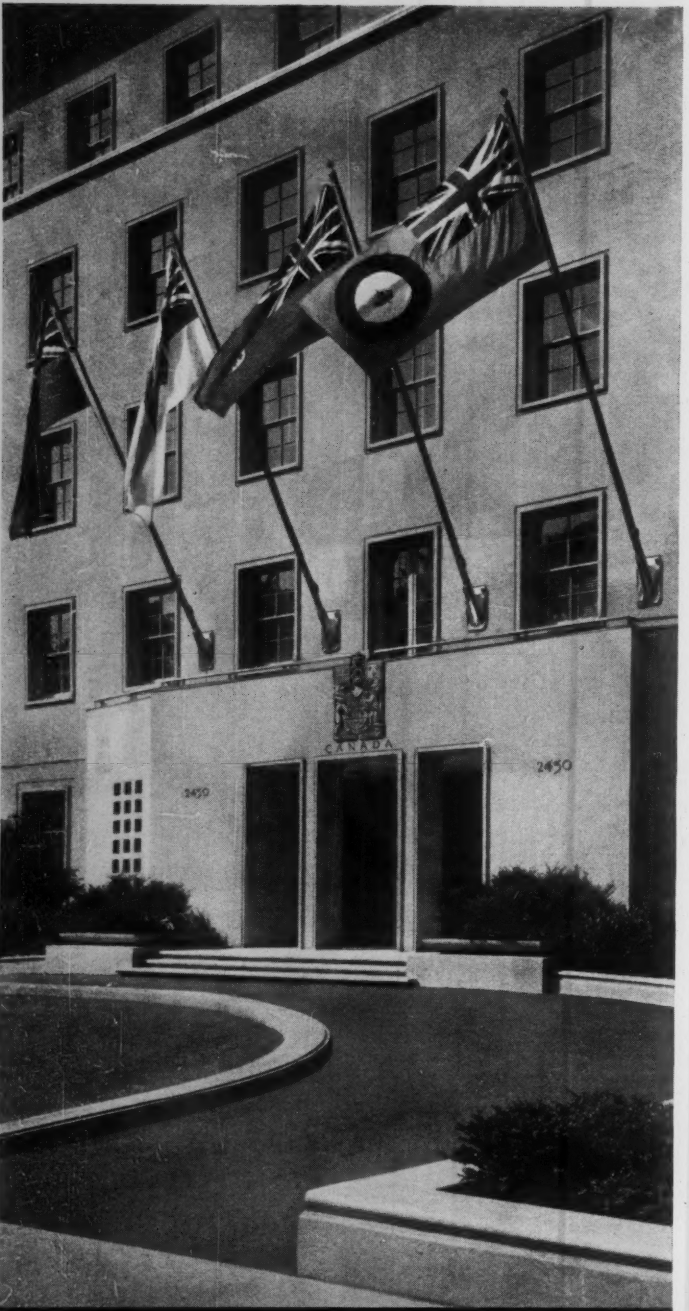
* for air handling systems

Your Standard of Silence

Air Conditioning Department
INDUSTRIAL ACOUSTICS COMPANY, INC.
341 Jackson Avenue, New York 54, N.Y.
CYpress 2-0180
"Specialists in Noise and Pulsation Control"

☐ **Send Complete Details of Quiet-DUCT Packaged Silencers.**
☐ **Have Representative Call.**

Name____________________Title__________
Company______________________________
Address______________________________



Architects:

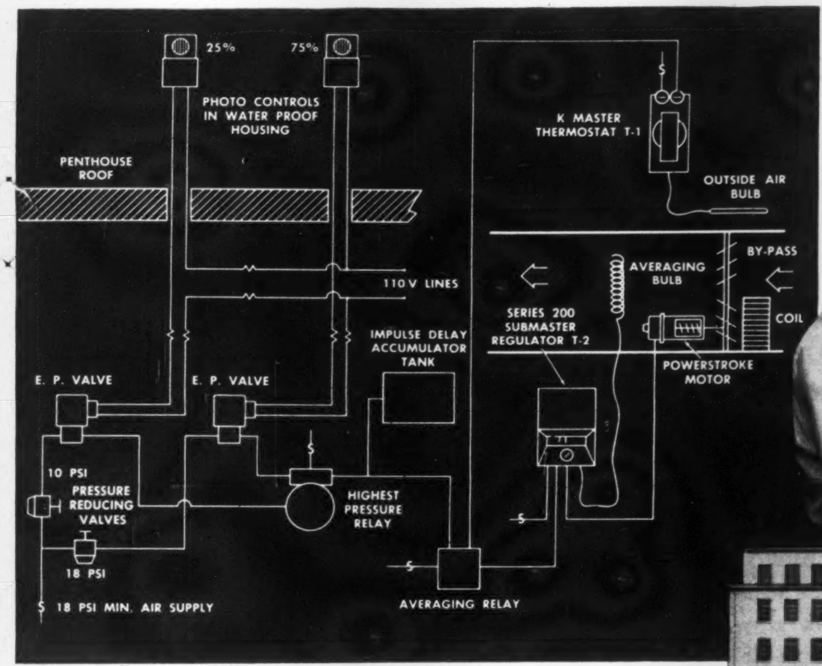
Marani, Morris & Allan, Toronto, Ont., Canada
Associated with
Faulkner, Kingsbury & Stenhouse, Washington, D.C.

Consulting Engineer:
Charles S. Leopold, Inc., Philadelphia, Pa.

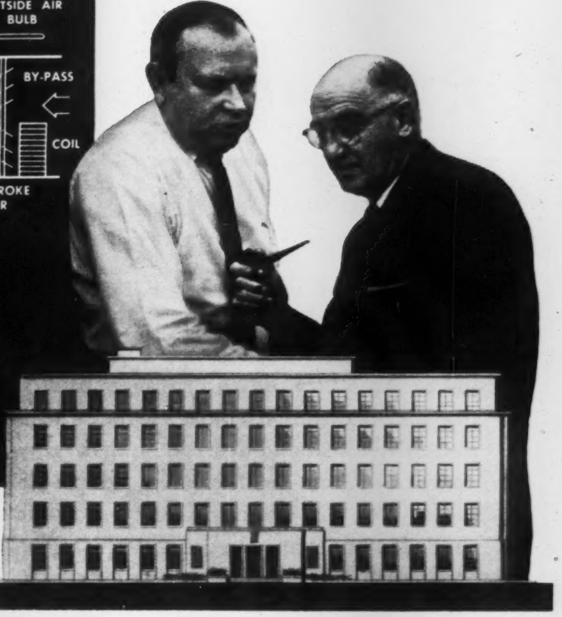
HOW TO SAVE COOLING DOLLARS WITH SUNPOWER

Consulting Engineer, Charles S. Leopold, confirmed his reputation for imaginative engineering when he put the sun to work in the air conditioning system of the Canadian Joint Staff Building, Washington, D. C. As a result, the occupants enjoy year-round comfort.

The Powers SOLARTOL, an electronic-pneumatic system designed to measure solar intensity and regulate air conditioning systems accordingly, is used to accomplish this.


25%
75%
PHOTO CONTROLS IN WATER PROOF HOUSING
PENTHOUSE ROOF
110 V LINES
IMPULSE DELAY ACCUMULATOR TANK
E. P. VALVE
E. P. VALVE
10 PSI
PRESSURE REDUCING VALVES
18 PSI
18 PSI MIN. AIR SUPPLY
HIGHEST PRESSURE RELAY
AVERAGING RELAY
K MASTER THERMOSTAT T-1
OUTSIDE AIR BULB
BY-PASS
AVERAGING BULB
SERIES 200 SUBMASTER REGULATOR T-2
COIL
POWERSTROKE MOTOR

Solartrol control circuit for each building exposure.



G. Titus Fenn, chief designer, and Charles S. Leopold.

■ ■ ■ ■ ■ ■ ■

HOW IT WORKS—Four pairs of photo-electric cells are mounted on the roof, each pair measuring the solar radiation falling on one side of the building which is oriented 45° from the true north-south. They are connected to submaster thermostats that control conditioned air temperature for each exterior zone in the building. One cell of each pair is set to operate at 25% Solar Gain and the other at 75%.

With no sunlight, an outdoor-air master-thermostat regulates the conditioned air temperature. As outside temperature rises from 78° to 95°, the zone air supply controls reset through a range of 68° to 63°.

With 50% Solar Intensity, the thermostat controls for that particular building zone are adjusted to operate at a 5° lower temperature range — 63° to 58° — to compensate for the additional heat of the sun.

With 100% Solar Intensity, the zone air supply controls are adjusted to operate at a still lower temperature range — 59° to 54°.

By varying the temperature of the air in the zone duct according to solar intensity as well as outdoor temperature, the final room controls operate more accurately. Equally important is a definite economy of refrigeration.

Powers controls systems and "Imaginative Engineering" — are establishing new highs in comfort conditioning. Case histories are available — ask for them.

THE POWERS REGULATOR COMPANY

DEPT. 1160 – SKOKIE 6, ILLINOIS | *Offices in Principal Cities in U.S.A. and Canada*

MANUFACTURERS OF THERMOSTATIC CONTROLS SINCE 1891

Hoffman Industrial Specialties *for air, water, steam or other fluids . . .*

Do you have a Pressure Reducing PROBLEM?

Hoffman Pressure Reducing Valves are designed and engineered for a wide range of applications where pressure of fluids must be reduced from a higher initial pressure to a lower secondary pressure. Single seated, dead-end or continuous operation. All parts are renewable and interchangeable. Valve seat and disc can be changed without removing valve body from the line. Easily adaptable to a wide variety of services, depending on the type diaphragm and disc used. Hoffman has Pressure Reducing Valves for heating equipment . . . process work . . . air conditioning . . . water, air, or gas. Check your requirements! Select the Hoffman Valve you need! Or write for further information!

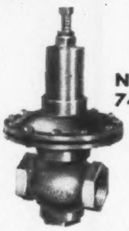
No. 710

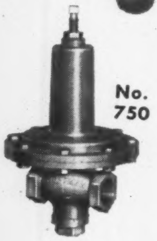
PRESSURE REDUCING VALVE SELECTION CHART

	700	710	715	720S	720W	740	750	758
SIZE—Inches	½-8"	½-1½"	2-4"	¾-6"	¾-6"	½-8"	½-1"	¼-½"
MAX. INITIAL PRES. PSI	200	250	250	250	250	250	250	300
MAX. REDUCED PRES. PSI	15	80	125	125	15	125	125	180
MIN. REDUCED PRES. PSI	1	5	5	15	2	5	2.5	5
STEAM SERVICE	●	●	●	●	●		●	
WATER SERVICE		●				●	● *	●
AIR SERVICE		●	●	●	●	●	● *	●
GAS SERVICE		●	●			●		●
OIL SERVICE		●	●				●	
SINGLE SEATED		●	●	●	●	●	●	●
DOUBLE SEATED	●							
SPRING LOADED DIAPHRAGM		●	●	●		●	●	●
WEIGHT & LEVER	●				●			
CONTINUOUS SERVICE	●	●	●	●	●	●	●	●
DEAD END SERVICE		●	●	●	●	●	●	●

*When specified, diaphragm must be changed from phosphor bronze to rubber.

No. 700


No. 740


No. 750

No. 758

HOFFMAN GUARDIAN OF YOUR HEALTH AND COMFORT

HOFFMAN SPECIALTY MFG. CORP.

1700 West 10th Street, Indianapolis 7, Indiana

Valves, Traps, Strainers, Pumps, Regulators • Sold by leading Wholesalers of Heating Equipment

LETTER FROM THE EDITOR

November 1960

Dear Reader:

Power piping design and installation is featured on the cover this month and in the article on pages 109 to 113 by A. W. Severance and W. C. Shepherd. The authors had major parts in the design of the power piping systems for the new Stratton station for the Ohio Edison Co. The design of these systems is centered around the four boiler-turbine generating units which are being installed successively over a four year period. Since the units are identical, the double-parallel main steam and reheat piping design for the first unit applies to the second, third, and fourth as well. Further economies are possible from the experience gained while completing the first and second units, now in operation. The choice of piping materials, the methods used for stress relieving, and the final cleaning of the system are also explained.

The variety of systems designed to meet the many comfort requirements in a new research center is explained by H. C. Moore and F. M. Gunby, Jr. in their article on page 114. They tell why it was decided to use a steam generating plant, why hot water baseboard radiation is used in some areas, why warm air is used in other areas, and how these systems are controlled. Separate chilled water systems in each of the four buildings are used for summer air conditioning and as a part of the reheat and dehumidification plan for computer and laboratory areas. Tempered makeup air is supplied to a high-bay shop and test building from which large quantities of air are exhausted.

To solve a failure problem in a paper plant when the production rate was increased, K. W. Huffman explains how a tank with a float level feed was installed in the coolant piping system in his article on page 119.

Solar air conditioning seems to be closer, as reported by Melvin Eisenstat, Frank M. Flanigan, and Erich A. Farber in their article on pages 120 to 126. The results of a comprehensive study of an ammonia-water absorption refrigeration system using hot water from a flat-plate solar absorber for regeneration indicates that such a system is feasible. The temperature of the hot water used for regeneration varies from 140 to 180 F, a range that is readily obtained with present-day commercial flat-plate solar absorbers. An intermittent cycle was tested, and even under these conditions the system seemed to be practical.

Sizing the suction line in a refrigeration piping system will influence the operating cost of that plant considerably, according to Herman Vetter. In his article on page 127, he presents three examples and compares operating costs to show the importance of checking all factors before sizing piping systems.

A new plan to improve bidding practices has been accepted by the four categories of mechanical specialty work in the Chicago area. The article on page 129 outlines the plan and explains how it will cut costs, eliminate bid shopping and bid peddling, and provide other advantages. If you have any comments on this, I would like to hear from you.

LETTER FROM THE EDITOR (continued) --

Infrared radiant heating and what we need to know about it in order to use it satisfactorily is explained by Robert L. Boyd in his article on page 133. He points out how infrared heating has been misapplied in some cases and what precautions should be used in designing and installing these systems. He limits his discussion to quartz lamps and tubes and metal sheathed heaters, but many of the principles apply to other types also. A method of determining the proper heater sizes is also presented together with the effect that position, wind conditions, and clothing of the individual have on the results that may be experienced.

In his page this month, Sam Lewis says: "Keep up with engineering progress and customs on the European side." This interesting discussion of the differences in terminology between the two continents points out some areas where engineers could be more specific.

A new graph is presented this month as the HPAC Data Sheet on page 143 which relates the thermo-physical properties of saturated water and steam to temperature. The curves have been developed by J. S. Hucks over a period of years during his course of work on heat transfer and fluid mechanics for nuclear reactor design.

Selecting a centrifugal pump for a specific process piping application requires a knowledge of the bronze alloys used in pumps to prevent a failure resulting from corrosive effects caused by the fluid being pumped. In his article (pages 145-150), Harold W. Woodhouse presents a basic course in the bronze alloys and where they are best used. He has assembled a comprehensive table consisting of 95 bronze alloys made by American manufacturers showing the application and the degree of corrosion resistance that may be experienced in service.

What water treatment can and should do for you is presented by Urban D. Kapler in his article on page 151. He explains in a brief and frank manner the basic facts that are needed to evaluate the necessary water treatment plan for heating, piping, and air conditioning systems.

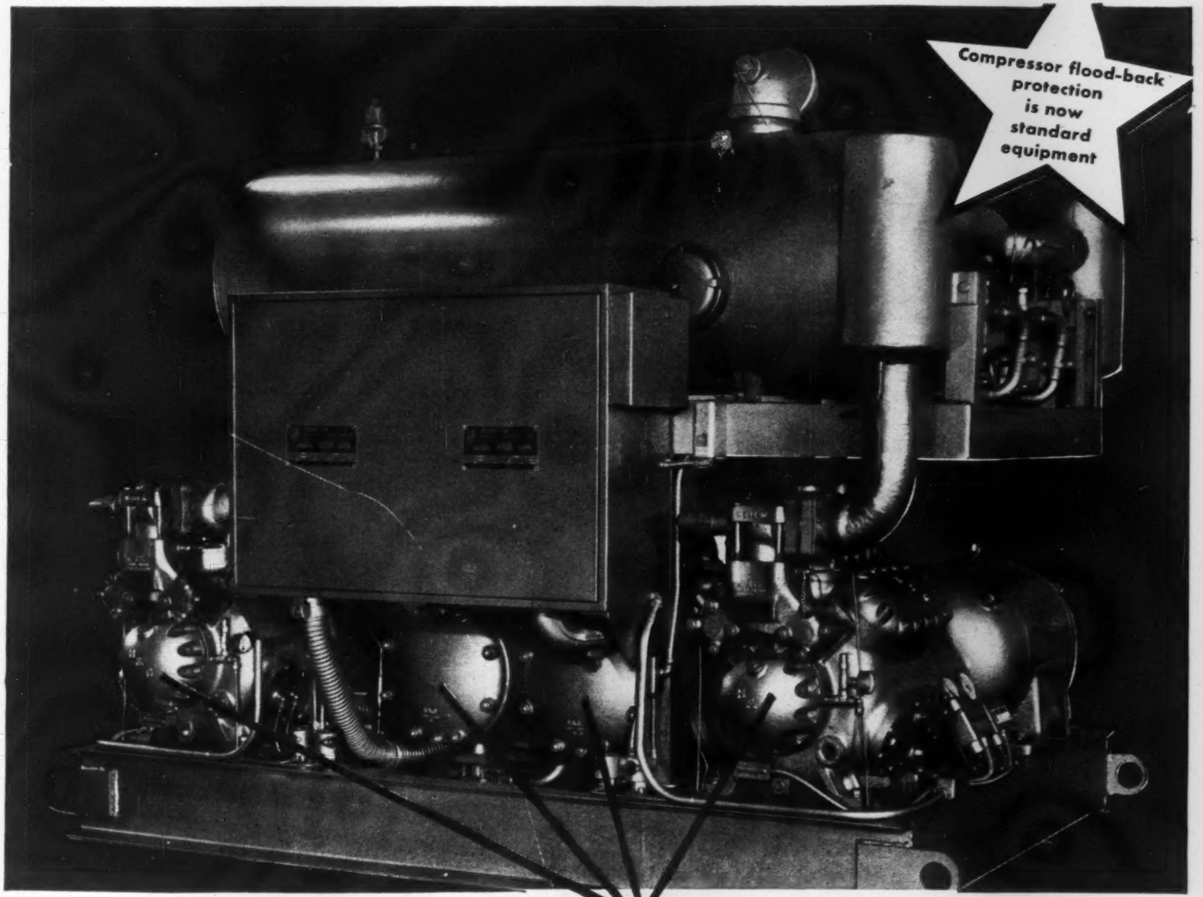
A consolidation of the design considerations for nuclear piping systems is presented as this month's "HPAC Engineering Data File," beginning on page 153. Don Bahnfleth, HPAC's Engineering Editor, consulted many sources of information on this subject before preparing the 16 page report which includes a discussion of the codes that are applicable, the effects of radiation on various piping materials, some of the corrosion problems that may be encountered, and the need for considering accessibility in design. I am sure that you will find it to be another valuable feature.

Effective boiler corrosion prevention starts before corrosive action begins, according to John W. Turner in his answer to the question, "How Can We Protect Boiler's Internal Metal Surfaces?" on pages 104 and 106.

Many interesting and timely items worthy of your attention are in the "You'll Want to Know" pages (39 to 44). The "Open for Discussion" pages are 99 and 102 which contain comments about previously published information in these pages.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING



Compressor flood-back protection is now standard equipment

NOW 2
COMPLETE CIRCUITS IN ONE COOLER

Another example of B&G creative engineering!

The B&G Package Liquid Cooler is now available *with two complete refrigeration circuits*...dual compressors, dual condensers and a single evaporator! It has a capacity reduction to 25%—in stages of 100, 75, 50 and 25%. All operative and safety controls are installed and pre-wired.

An outstanding feature is the automatic lead-lag selector switch. In operation, No. 1 motor and compressor handle the load until cooling requirements are satisfied or until No. 2 unit needs to be called into use.

On the next starting, No. 2 unit picks up the load. Therefore each motor and compressor gets equal usage. This dual arrangement is also valuable because it provides stand-by protection in case of emergencies.

Remember, too, that all major parts of B&G "package" units are manufactured and guaranteed by Bell & Gossett Company...*one* responsibility for satisfactory operation.

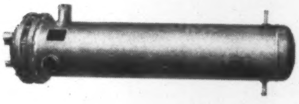
Send for complete specification and application data on B&G Air Conditioning and Refrigeration equipment.

BELL & GOSSETT COMPANY

Dept. RGK-5, Morton Grove, Illinois

Canadian licensee: S. A. Armstrong, Ltd.,
1400 O'Connor Drive, Toronto 16, Ontario

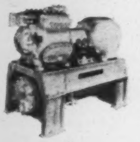
A FULL LINE OF REFRIGERATION AND AIR CONDITIONING "PACKAGES" AND COMPONENTS



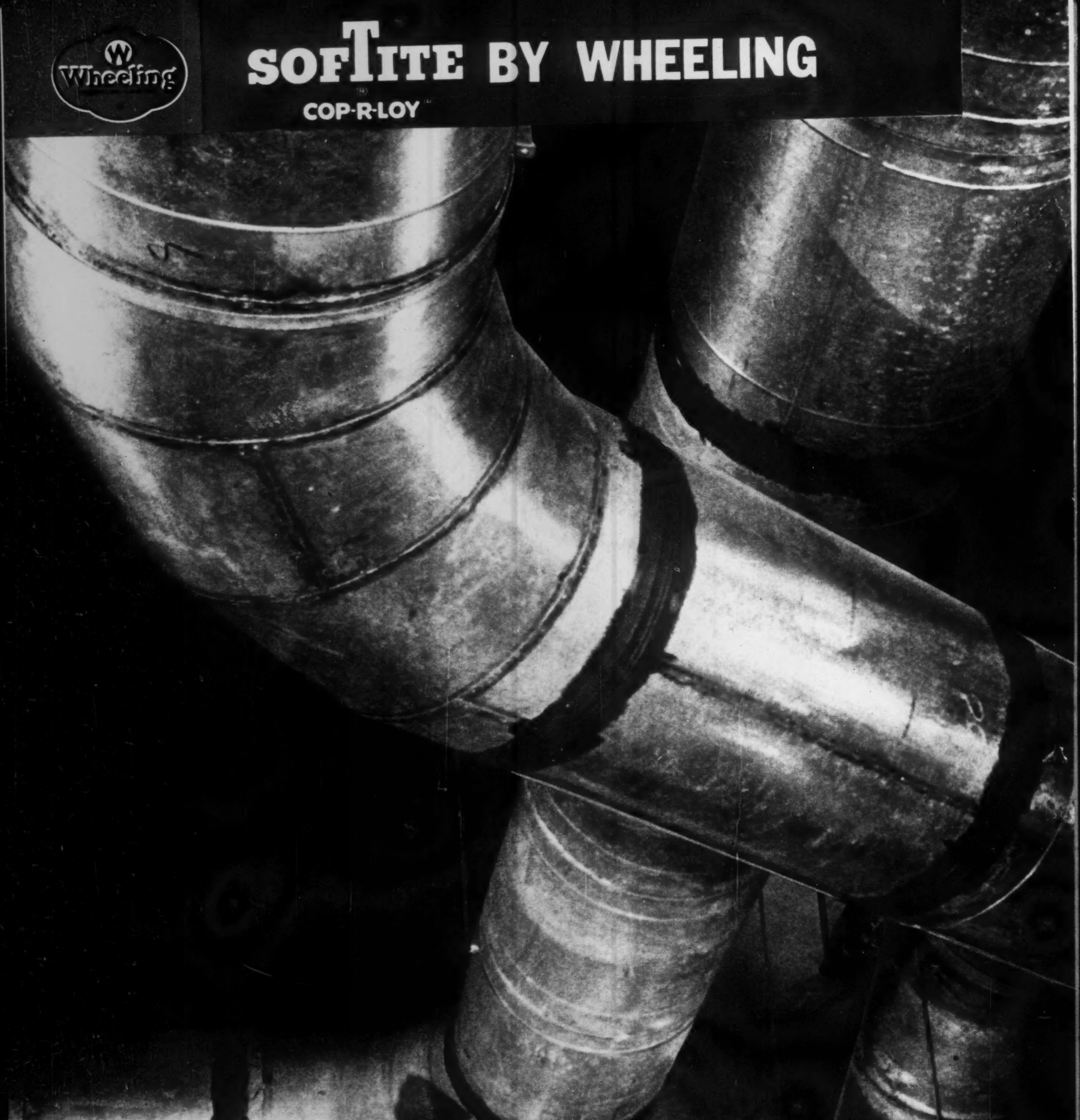
B&G Evaporator

B&G Centrifugal Pump

B&G Condenser



B&G Condensing Unit



Wheeling
SOFTITE BY WHEELING
COP-R-LOY

WHEELING
SOFTITE®
COP-R-LOY®
L.F.Q.

"First choice by far!"

— That's what they're saying all over America about Wheeling SOFTITE Galvanized Sheets! For SOFTITE has everything sheet metal men want in a galvanized sheet. Here's why:

1. SOFTITE sheets work easier because they are soft and ductile.
2. SOFTITE's galvanized coating is applied so tightly that it actually becomes a part of the steel base . . . can't flake or peel no matter how you twist or torture it.
3. SOFTITE, made of famed Cop-R-Loy, lasts longer . . . gives more years of service for your customer's dollar.

Get the full facts on dependable, easy-to-work SOFTITE Galvanized Cop-R-Loy Steel Sheets from your Wheeling man this week. Or write Wheeling Corrugating Company, Wheeling, W. Va.

Steel

WHEELING CORRUGATING COMPANY • IT'S WHEELING STEEL!

WHERE TO FIND THE NEAREST WHEELING WAREHOUSE

BOSTON
2 Thompson Square
Charlestown District
Boston 29, Mass.
Charlestown 2-4770

BUFFALO
1722 Walden Ave.
Buffalo 25, N. Y.
Keystone 7444

CHICAGO
2547 Arthington St.
Chicago 12, Ill.
Seeley 3-5700

COLUMBUS
1100 Steelwood Road
Columbus 12, Ohio
Hudson 6-4318

DETROIT
6410 Miller Road
Dearborn 1, Mich.
Luzon 4-2005

KANSAS CITY
820 Atlantic Street
N. Kansas City 16, Mo.
Grand 1-4141

LOUISVILLE
1424-1436 S. 15th St.
Louisville 10, Ky.
Melrose 4-0541

MINNEAPOLIS
340-400 27th Ave., N.E.
Minneapolis 18, Minn.
Sterling 9-7233

NEW ORLEANS
1560 Tchoupitoulas St.
New Orleans 1, La.
Jackson 5-2291

NEW YORK
47-04 Van Dam Street
Long Island City 1, N. Y.
Stillwell 4-8580

PHILADELPHIA
3rd and Bristol Streets
Nicetown Station
Philadelphia 40, Pa.
Davenport 9-1600

RICHMOND
1600 Jeff. Davis Hwy.
Richmond 24, Va.
Belmont 3-6936

ST. LOUIS
722 S. Vandeventer Ave.
St. Louis 10, Missouri
Jefferson 1-3900

SALES OFFICES:

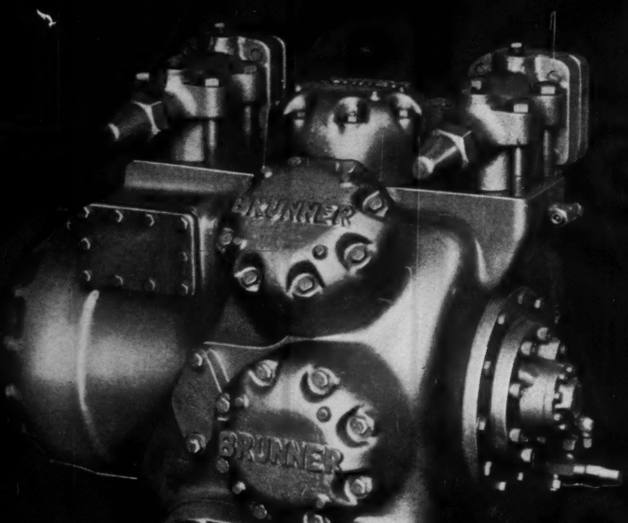
ATLANTA
1013 Wm. Oliver Bldg.
Atlanta 3, Georgia
Jackson 4-0866

HOUSTON
1303 Prudential Bldg.
1100 E. Holcombe Blvd.
Houston 25, Texas
Jackson 8-2692

WHEELING
1134-40 Market St.
Wheeling, W. Va.
Cedar 3-2200

BRUNNER
SINCE 1906

...the most complete line of



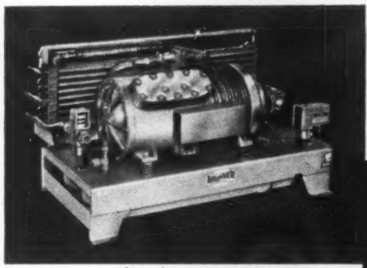
EXCELLENCE...
through supremacy
in design and
engineering

reciprocating compressors

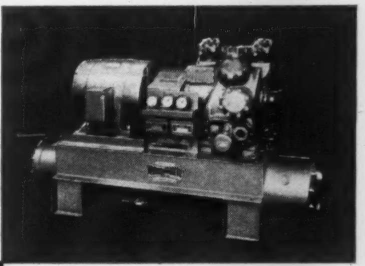
For refrigeration and air conditioning, you can select the unit you want and need . . . you're not compelled to compromise on what's available . . . when you specify a BRUNNER compressor or condensing unit.

Ranging from ¼ H.P. through 15 H.P. in the famed Brunner-metic line, and from 10 H.P. through 100 H.P. in the versatile Multi-Drive line, these units offer a selection which permits unlimited flexibility in specifying.

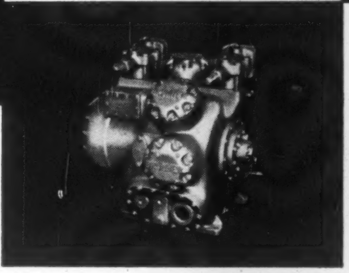
And behind every Brunner product is the peace of mind reassurance represented by over 50 years experience in the design and manufacture of quality compressors.



Brunner-metic units are available in the following series: air cooled, water cooled, combination air-and-water cooled, capillary tube, truck and remote condenser system models. Compressor capacities range from ¼ H.P. through 15 H.P. Bolted construction permits easy dismantling for servicing. Suction gas cooled motor contributes to higher efficiency and longer life. Crankshafts are dynamically and statically balanced for smooth operation.



The Multi-Drive line consists of compressors and condensing units from 10 H.P. to 100 H.P. with temperature ranges for air conditioning and refrigeration applications. Direct drive, hermetically sealed and belt driven models are available. Interchangeability of components keeps replacement part needs at a minimum. Aluminum pistons and connecting rods, integral lubrication system, built-in capacity control and oil failure switch are just a few of the superior design features which are standard on these units.



Hermetic compressors of the Multi-Drive line range in capacity from 10 H.P. to 100 H.P. and use R-22 refrigerant. Temperature ranges are from 10° to 50°F. Features include a motor winding or stator that can be conveniently removed without the use of special tools, a safety device specifically designed to automatically trip all three phases of current as a protection against motor burnout, and suction cooled motor windings which maintain lower motor temperatures and assure longer life.

BRUNNER DIVISION
DUNHAM-BUSH, INC.

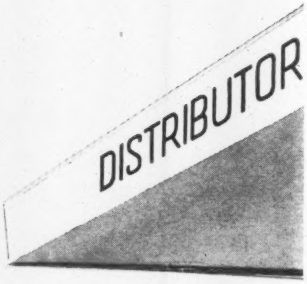
DUNHAM-BUSH

WEST HARTFORD 10 • CONNECTICUT • U.S.A.

MORE OF 'EM...QUICKER!

Another
PLUS VALUE
provided by your
TUBE TURNS
DISTRIBUTOR

Tube Turns' 12,000 stocked items comprise the world's broadest line of welding fittings and flanges. You can buy any of these on *one order*, from *one source* . . . your nearby Tube Turns' Distributor. This *wide selection and prompt delivery* simplify purchasing, assure matching of specs, reduce job delays, cut costs. Outstanding *availability service* is just one of the many PLUS VALUES you get when you specify and buy top-quality TUBE-TURN* products. Others are shown here.

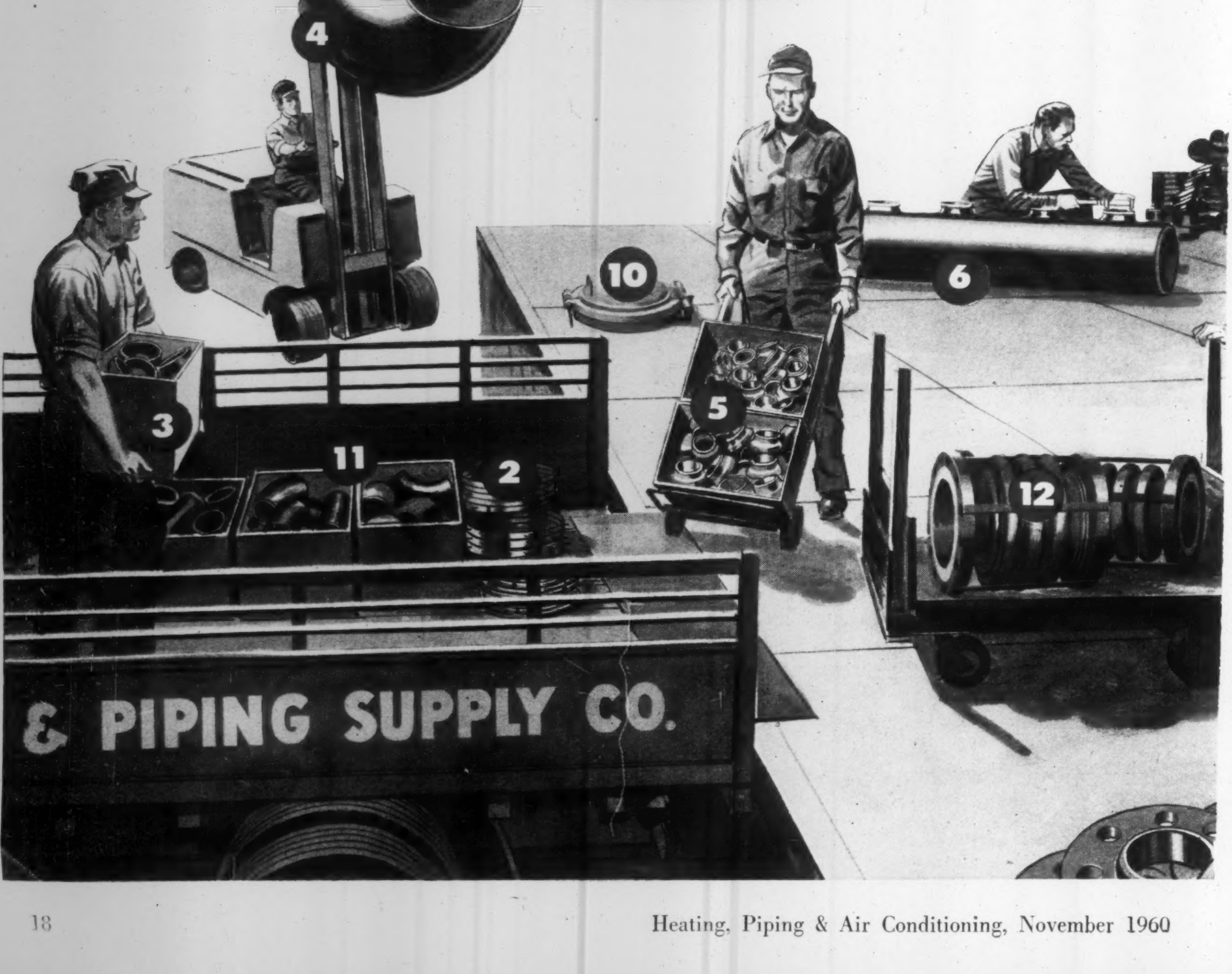


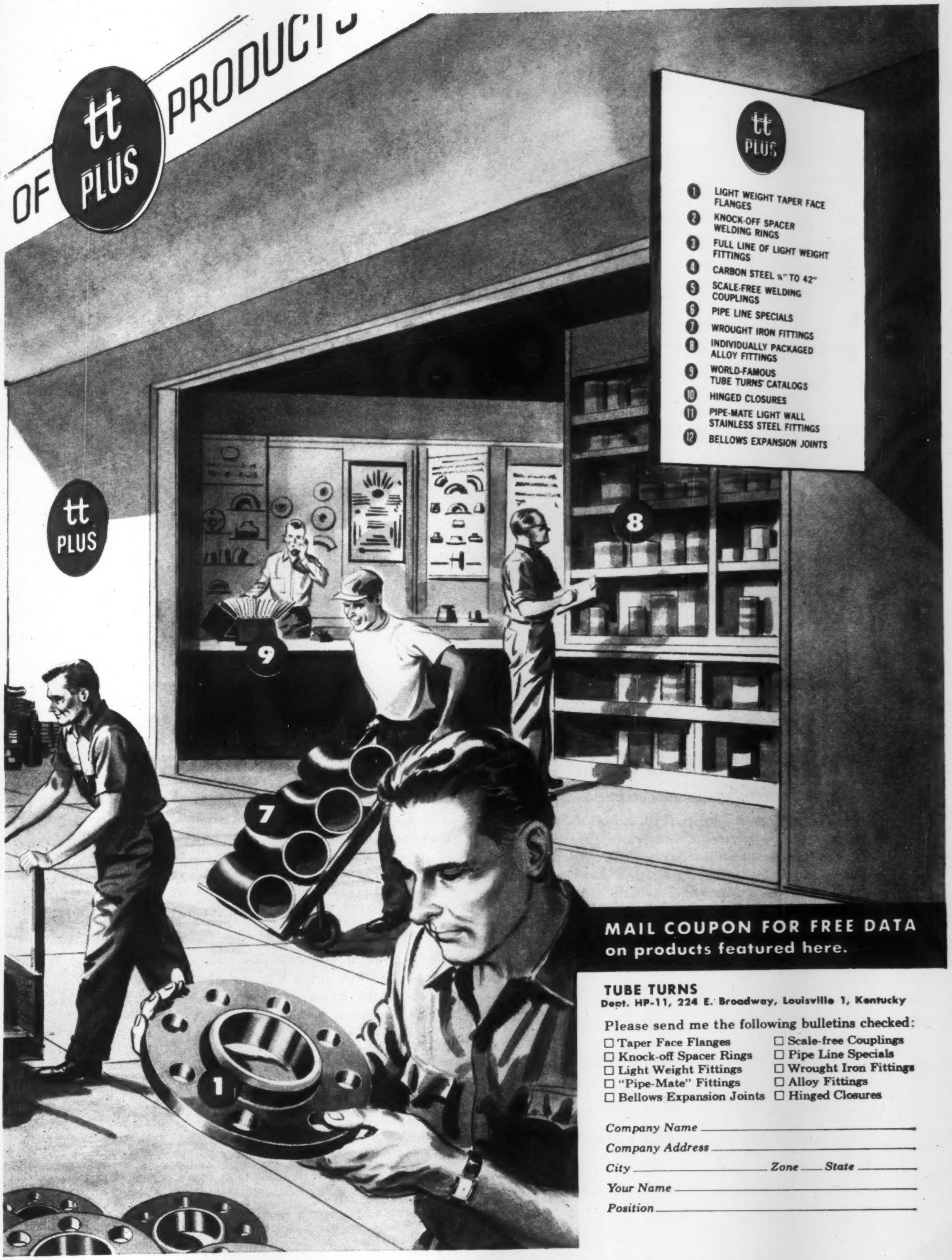
DISTRICT OFFICES: Atlanta • Buffalo • Chicago • Columbus • Dallas Denver • Detroit • Houston • Kansas City • Los Angeles • New York Philadelphia • Pittsburgh • Richmond • St. Petersburg • San Francisco • Seattle Shreveport • Tulsa

In Canada: TUBE TURNS OF CANADA LIMITED, Ridgetown, Ontario
District Offices: Edmonton • Montreal • Toronto
In Mexico: TUBE TURNS DE MEXICO, Mexico City

*"TUBE-TURN", "tt" and "PIPE-MATE" are trademarks of Tube Turns.

TUBE TURNS
DIVISION OF CHEMETRON CORPORATION
Louisville 1, Kentucky
CHEMETRON





OF tt PLUS PRODUCTS
tt PLUS
tt PLUS
1 LIGHT WEIGHT TAPER FACE FLANGES
2 KNOCK-OFF SPACER WELDING RINGS
3 FULL LINE OF LIGHT WEIGHT FITTINGS
4 CARBON STEEL ½" TO 42"
5 SCALE-FREE WELDING COUPLINGS
6 PIPE LINE SPECIALS
7 WROUGHT IRON FITTINGS
8 INDIVIDUALLY PACKAGED ALLOY FITTINGS
9 WORLD-FAMOUS TUBE TURNS' CATALOGS
10 HINGED CLOSURES
11 PIPE-MATE LIGHT WALL STAINLESS STEEL FITTINGS
12 BELLOWS EXPANSION JOINTS
tt PLUS
9
8
7
1

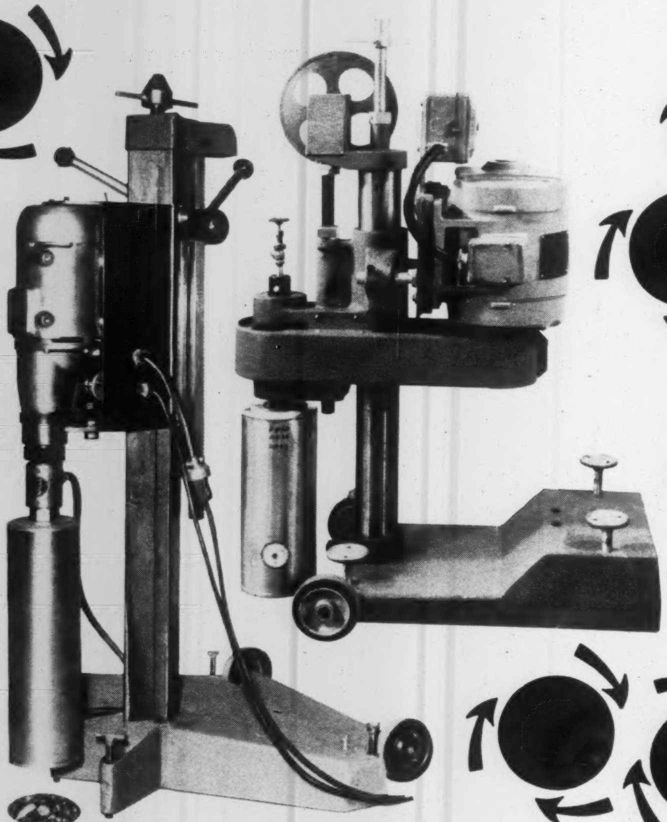
MAIL COUPON FOR FREE DATA on products featured here.

TUBE TURNS
Dept. HP-11, 224 E. Broadway, Louisville 1, Kentucky

Please send me the following bulletins checked:

☐ Taper Face Flanges
☐ Knock-off Spacer Rings
☐ Light Weight Fittings
☐ "Pipe-Mate" Fittings
☐ Bellows Expansion Joints
☐ Scale-free Couplings
☐ Pipe Line Specials
☐ Wrought Iron Fittings
☐ Alloy Fittings
☐ Hinged Closures

Company Name ____
Company Address _______________________________________
City ________________ *Zone* ____ *State* __________
Your Name ____
Position ____



POWER + SPEED IS MONEY SAVED WITH MOLCO DRILLING EQUIPMENT

Power matched Molco drilling machines and uniquely designed Molco diamond bits give you faster bit penetration, longer bit life and greater overall job economy. Ruggedly built to give years of dependable service. The most versatile and portable machines available on the market today. Called on over and over again to solve the most difficult drilling jobs encountered. Here are two machines which may solve your drilling problem.

THE MOLCO MODEL R

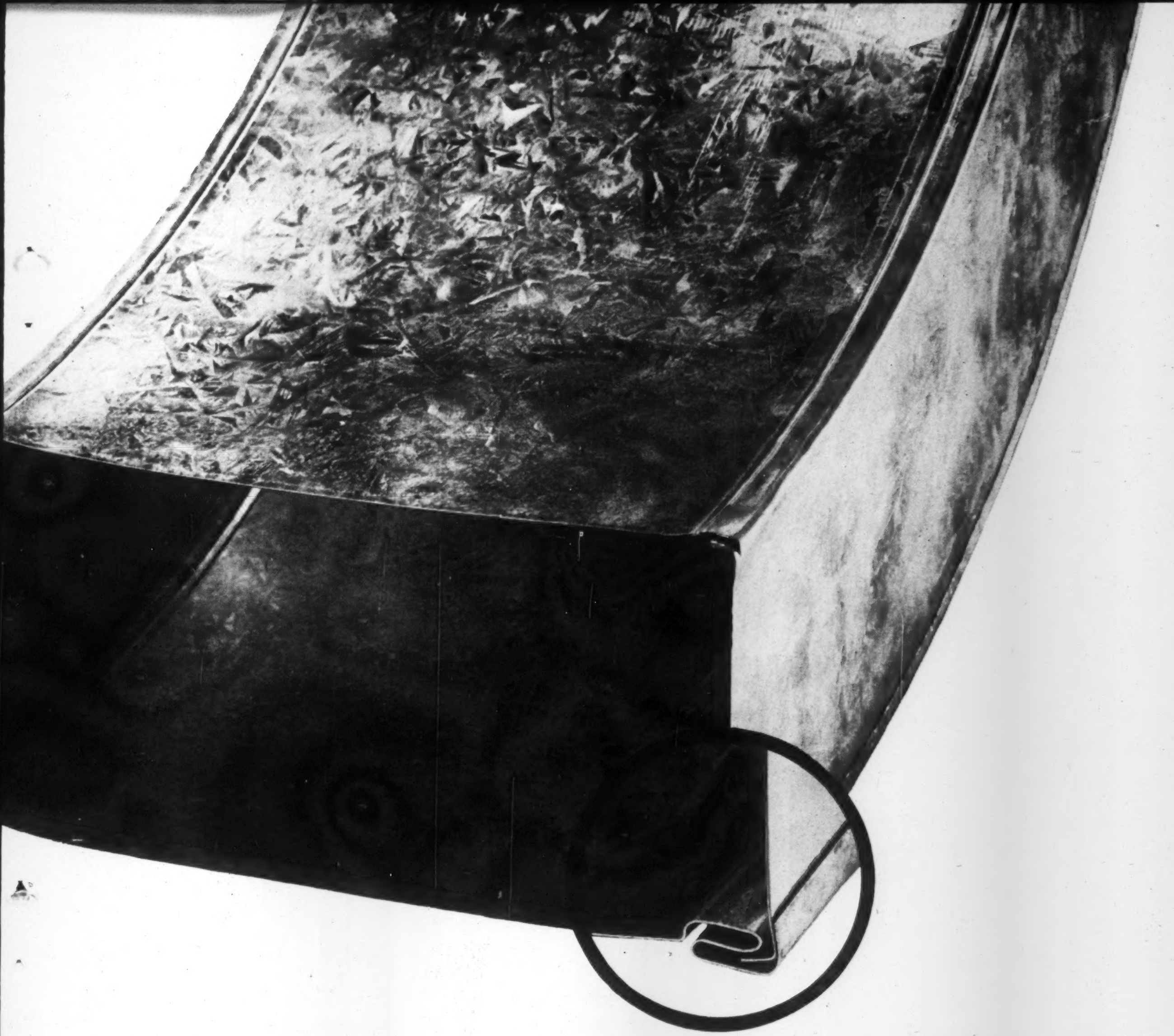
Unitized, lightweight, all steel rugged construction. Packed with many standard features to give fastest drilling time at lowest possible cost.
Can be equipped with vacuum base to create a holding pressure of 2,000 pounds giving greater rigidity to the machine ensuring longer bit life.

THE MOLCO MODEL II

The workhorse of the Molco line. Designed for productions jobs where speed is of the utmost importance. With the reserve to cut hole after hole to afford you the most economical method of hole and core drilling.

JOB PROVEN MACHINES • FASTER PENETRATION • SPECIAL BIT DESIGN • LONGER BIT LIFE • DESIGNED AND PRICED RIGHT • EXTRA POWER • MOLCO MEANS "LOWEST COST PER HOLE"

MOLCO DRILLING MACHINES, INC.
909 FRANKLIN ST., N. E., WASHINGTON, D. C. DE 2-7795



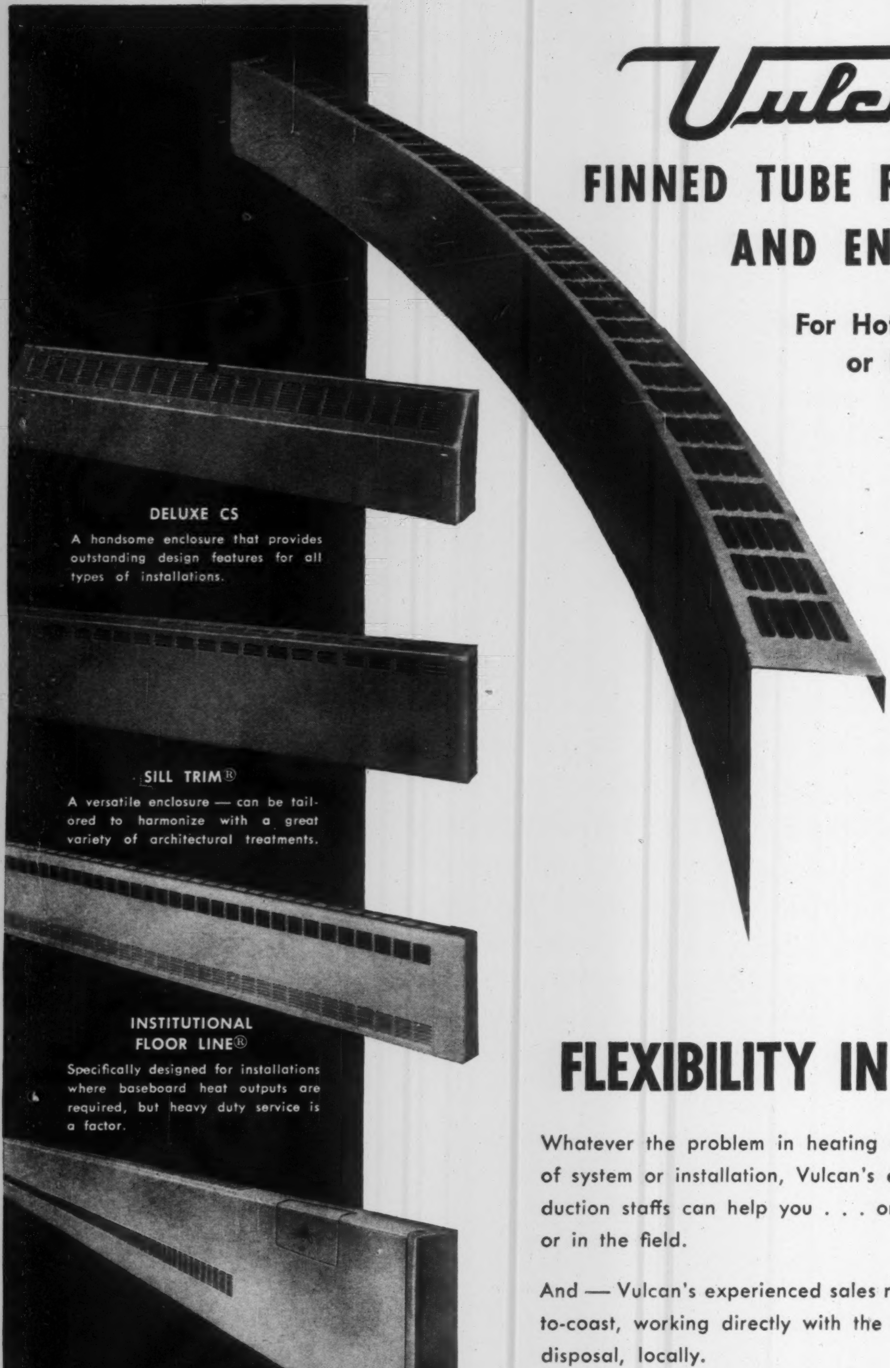
Lock seaming ceases to be a problem when you use Weirkote Zinc-Coated Steel. This modern continuous-process tightly bonded zinc-coated steel won't peel, chip or flake. Work it to the limits of the steel base itself and the zinc coating remains intact assuring you of the complete corrosion protection that only zinc can give. A Weirton representative will be happy to supply more complete information on Weirkote—another fine product of the Weirton Steel Company, Weirton, West Virginia.

Look for the STEELMARK on the products you buy; place it on the products you sell.

WEIRTON STEEL
Weirton, West Virginia

Weirton Steel is a division of **NATIONAL STEEL CORPORATION**

Weirkote will also be available in 1961 from National's Midwest Steel Division, Portage, Indiana.



Vulcan®

FINNED TUBE RADIATION AND ENCLOSURES

For Hot Water, Steam or Electric Systems

DELUXE CS

A handsome enclosure that provides outstanding design features for all types of installations.

SILL TRIM®

A versatile enclosure — can be tailored to harmonize with a great variety of architectural treatments.

INSTITUTIONAL FLOOR LINE®

Specifically designed for installations where baseboard heat outputs are required, but heavy duty service is a factor.

LINOVENTILATOR®

The new low-cost heating and ventilating system for schoolrooms and offices. More compact, slimmer, Linoventilator allows up to twice as much usable floor space.

Manufactured and sold in Canada by Vapor Heating (Canada) Ltd., 3955 Courtrai Ave., Montreal 26, Quebec.

FLEXIBILITY IN DESIGN

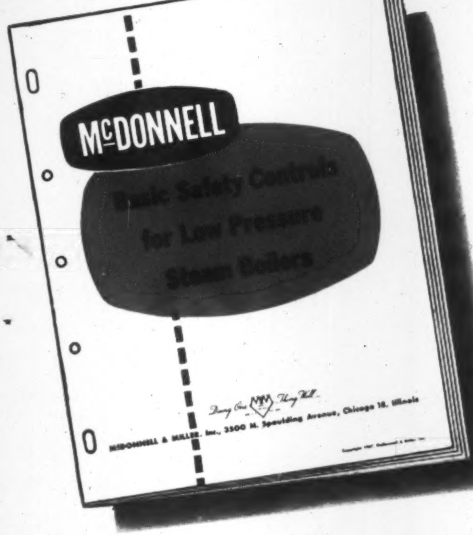
Whatever the problem in heating design, for any type of system or installation, Vulcan's engineering and production staffs can help you . . . on the drawing board or in the field.

And — Vulcan's experienced sales representatives, coast-to-coast, working directly with the Factory, are at your disposal, locally.

For Complete Information on Enclosures Shown, Call Your Nearest Vulcan Representative Or Write to Factory.

Vulcan® ORIGINATORS OF FIN-TUBE AND BASEBOARD RADIATION IN AMERICA

The **VULCAN** Radiator Company
775 CAPITOL AVENUE, HARTFORD 6, CONN.


McDONNELL

Basic Safety Controls for Low Pressure Steam Boilers

Doing One Thing Well

McDONNELL & MILLER, Inc., 3500 N. Spaulding Avenue, Chicago 18, Illinois

Basic Safety Controls for Low Pressure Steam Boilers—Answers all safety control problems that arise in low pressure steam field. The full story of correct hook-up and proper wiring in simple statements and clear diagrams.

McDONNELL

Basic Safety Controls for Hot Water Space Heating Boilers

Doing One Thing Well

McDONNELL & MILLER, Inc., 3500 N. Spaulding Avenue, Chicago 18, Illinois

Basic Safety Controls for Hot Water Space Heating Boilers—Companion piece to "steam" book opposite. Correct solution of all safety control problems in the area of hot water space heating boilers.

McDonnell Flow Switches—Points out the almost endless uses of flow switches for safety control and automatic control. Covers details of construction, service ranges, applications.

McDONNELL

Flow Switches

Versatile safety device or automatic control ... operated by pipeline flow

McDONNELL & MILLER, Inc., 3500 N. Spaulding Avenue, Chicago 18, Illinois

FOUR How-to-do-it BOOKS

Bulletins that make a basic contribution toward getting the results that every contractor or engineer wants...

...safer operation

...more efficient operation

...automatic operation

Read the brief descriptions of these booklets. Use the coupon to request any or all of them. Yours for the asking.

special applications of McDONNELL PRODUCTS

McDONNELL & MILLER, Inc., 3500 N. Spaulding Avenue, Chicago 18, Ill.

Special Applications of McDonnell Products—Twenty-one case studies of simple control problems that can turn up almost anywhere. Each case suggests others. Liquid level and flow control problems are clearly defined and met.

McDONNELL & MILLER, *Inc.*
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well
REG. U. S. PAT. OFF.

McDONNELL

BOILER WATER FEEDERS • LOW WATER FUEL CUT-OFFS • PUMP CONTROLLERS • RELIEF VALVES • FLOW SWITCHES • RELATED LIQUID LEVEL CONTROLS FOR TANKS, STILLS, AIR CONDITIONING SYSTEMS

Your Jobber Stocks McDONNELL Products

Coupon Brings Them

Send bulletin (or bulletins) checked:

☐ Steam Booklet, L-711
☐ Flow Switch Bulletin, FS1A
☐ Hot Water Companion Booklet, P-30-C
☐ Special Application Booklet, ERS-A

Company____________________________

Address____________________________

City, Zone, State________________________

By_________________________________

Mail to: McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

PROJECT: School

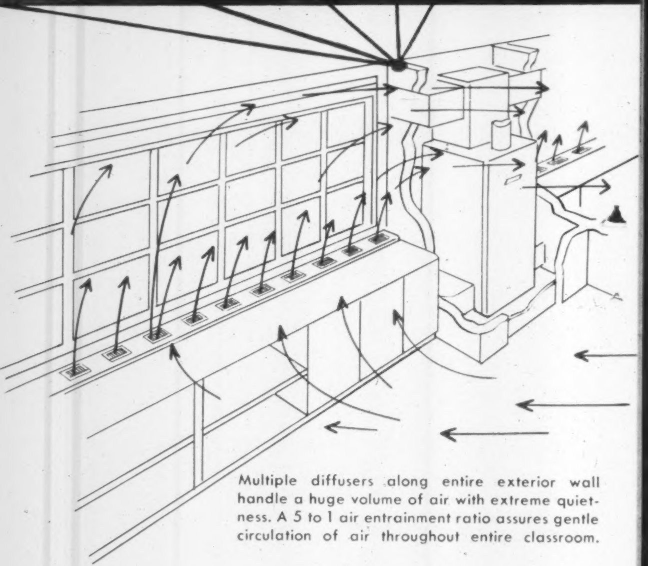
PLANNING: Highly Flexible

COST: $1.35 Sq. Ft. (Heating and Ventilating)

SPECIFIED: A modular Fresh Air Ventilating, Heating and Cooling System that lowered initial building costs and met all the needs for future expansion

St. John's High School, Jackson, Michigan
Myotte and Webb, Architects
Erwin Richardson, P. E.
East Lansing, Michigan

A LENNOX Comfort Curtain system completely ventilates, cools and heats this 15-Classroom addition, yet the cost per sq. ft. of the heating and ventilating was only $1.35. Gas fired heating sources, in approved construction heater rooms, are located on exterior walls between each two classrooms. An air processing unit in each room controls, blends and filters return and fresh air as demanded. This air is distributed continuously *across the full length of the classroom exterior walls* through functional, pre-finished metal bookshelf sections and wall ducts to eliminate cold spots, tired air and drafts. Individual Day-Nite thermostats maintain room temperatures within ½° of control setting. "No-occupancy" settings save fuel by recirculating warm air when fresh air is not required. Minimum structural requirements and ease of installation reduce both initial costs and over-all expenditures. As further building expansion occurs, modular design enables new units to be easily added. Comfort Curtain System provides for present or future air conditioning. Servicing can be handled by any qualified local heating contractor.



Multiple diffusers along entire exterior wall handle a huge volume of air with extreme quietness. A 5 to 1 air entrainment ratio assures gentle circulation of air throughout entire classroom.

For complete information about the Comfort Curtain System and its adaptability to in-the-room, two-room remote, central, hot water, steam, heat pump or electric heat sources, write LENNOX, 508 S. 12th Ave., Marshalltown, Iowa, or phone your nearest Lennox office, listed below, and ask for a Lennox technical representative to call.

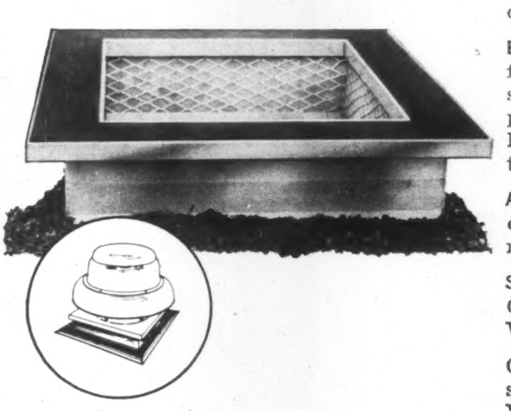
World leader in indoor comfort for homes, business, schools and industry

LENNOX®

Comfort Curtain

©1960 Lennox Industries Inc., founded 1895; Marshalltown and Des Moines, Ia.; Syracuse, N. Y.; Columbus, O.; Decatur, Ga.; Ft. Worth; Los Angeles; Salt Lake City. In Canada: Toronto, Montreal, Calgary, Vancouver, Winnipeg.

THE FIRST TO CURB ROOF EXHAUSTER NOISES WERE ENGINEERS AT PENN!



Penn's SONOTROL CURB *for all roof ventilator installations provides* 3 IMPORTANT BENEFITS *to the Specifying Engineer*

Putting the curb on prevailing problems that accompany roof ventilator installations was no easy task. Roof fan sounds had to be hushed. Field constructed curbs were often haphazardly put together; they overloaded roofs and lacked dimensional coordination for ventilators and dampers. But, engineers working at Penn developed the industry's first solution . . . the *Sonotrol Curb!*

EXTRUDED ALUMINUM, an exclusive in Penn's Sonotrol design features structural "I" beam lifetime construction; reinforced seamless outside wall; loading capability of more than 700 lbs. per lineal ft. with a minimum safety factor of 2.5; provides stabilized dimensions for all dampers and ventilators . . . and everything fits!

ACOUSTICAL-THERMAL INSULATION reduces decible build-up of exhauster at the source; attenuates resonance and reverberation; minimizes sone values; no reduction in air movement.

SELF-FLASHING eliminates the problem of field flashing over the Curb; installation is simplified; flashing flange incorporates V-groove serrations for maximum gripping power.

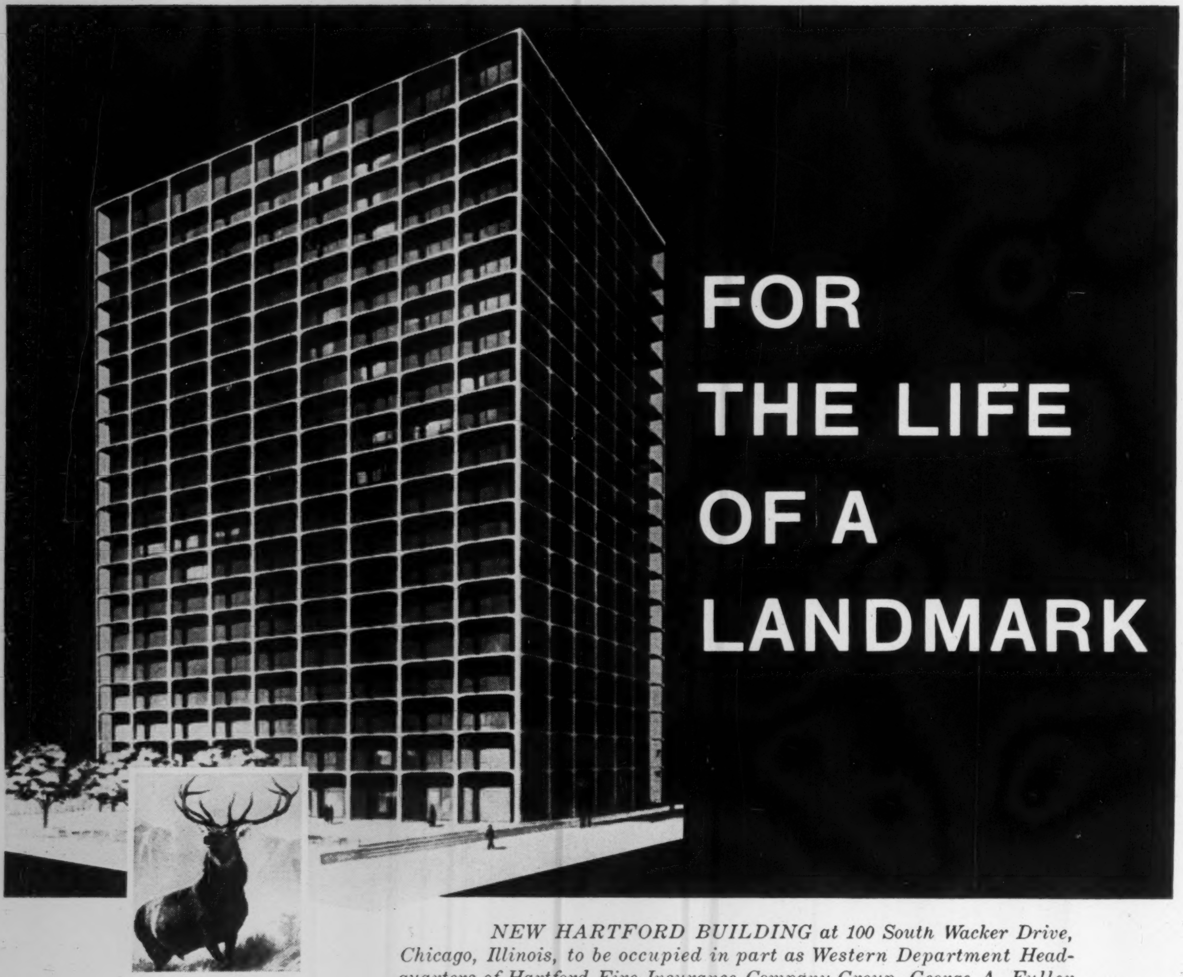
Get complete facts now on how Penn Ventilator can be your one source for the universally accepted Sonotrol Curb, Damper and Ventilator. Contact your local representative or write direct.

PENN VENTILATOR CO., Inc.
PHILADELPHIA 40, PENNA.

A leading manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 30 years.

Charter Member of AMCA

Penn Ventilator products are available throughout the Free World.
One of many direct factory representatives at your service:
Barrow & Daugherty, Atlanta, Ga.



NEW HARTFORD BUILDING at 100 South Wacker Drive, Chicago, Illinois, to be occupied in part as Western Department Headquarters of Hartford Fire Insurance Company Group. George A. Fuller Company, General Contractor. Skidmore, Owings & Merrill, Architect-Engineer. Economy Plumbing & Heating Company, Inc., Mechanical Contractor.

DOLLARS SAVED: IN CHICAGO'S NEW HARTFORD BUILDING, STEEL PIPE FROM REPUBLIC WAS SELECTED FOR COMPLETE DOMESTIC WATER, GAS AND STEAM DISTRIBUTION SYSTEMS. USE OF STEEL PIPE—BLACK AND GALVANIZED—SAVED THOUSANDS OF DOLLARS. MECHANICAL CONTRACTOR: ECONOMY PLUMBING AND HEATING COMPANY, INC., CHICAGO.

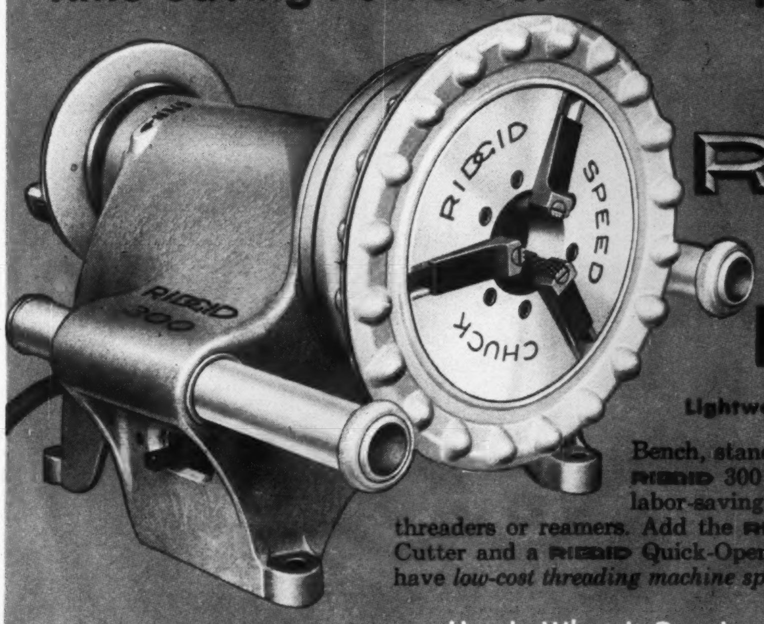
To get pipe that's clean and rust-free, try your Republic distributor. This man delivers pipe as you want it on the job. He delivers pipe that is easier to cut, thread, and bend. Call him today or write Republic Steel Corporation, Dept., HP-1245, 1441 Republic Bldg., Cleveland 1, Ohio.

REPUBLIC
STEEL

REPUBLIC STEEL PIPE

...MADE AND BACKED BY AMERICANS

Time-Saving Power For Your Shop or on the Job...



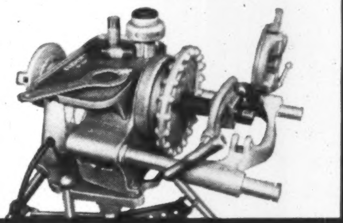
New RIDGID® 300 Power Drive

Lightweight • Versatile • Low in Price

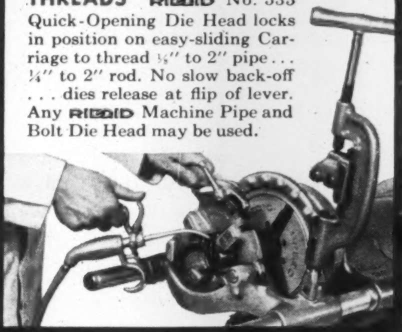
Bench, stand or truck mounted, this compact RIDGID 300 Power Drive gives you time and labor-saving power for your hand cutters, threaders or reamers. Add the RIDGID No. 310 Carriage, No. 360 Cutter and a RIDGID Quick-Opening Machine Die Head, and you have *low-cost threading machine speed and ease!*

Here's What it Does!

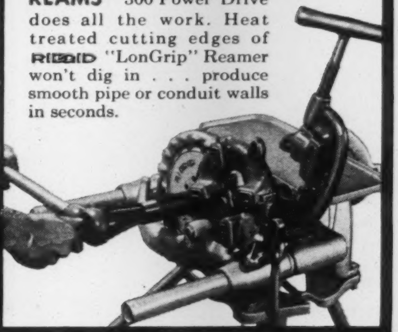
CUTS RIDGID No. 360 Cutter, shown here, cuts ⅛" to 2" pipe and conduit — up to ⅜" rod. Extra-wide rolls keep cutter straight for perfect high-speed tracking. Cutter stays back out-of-way when not in use.



THREADS RIDGID No. 535 Quick-Opening Die Head locks in position on easy-sliding Carriage to thread ⅛" to 2" pipe . . . ¼" to 2" rod. No slow back-off . . . dies release at flip of lever. Any RIDGID Machine Pipe and Bolt Die Head may be used.



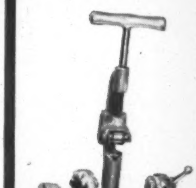
REAMS 300 Power Drive does all the work. Heat treated cutting edges of RIDGID "LonGrip" Reamer won't dig in . . . produce smooth pipe or conduit walls in seconds.



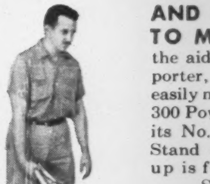
DRIVES GEARED THREADERS Compact, RIDGID No. 300 Power Drive has plenty of power for up to 12" geared tools. New RIDGID Close-Coupled drive shown here, for Nos. 141 and 161 Jam-Proof Threaders eliminates Universal Drive Shaft . . . saves working space.

THREADS CLOSE NIPPLES

No. 310 Carriage is so designed that by using a RIDGID No. 19 Nipple Chuck you can thread even close nipples right on the job... no waiting for nipples of special lengths.



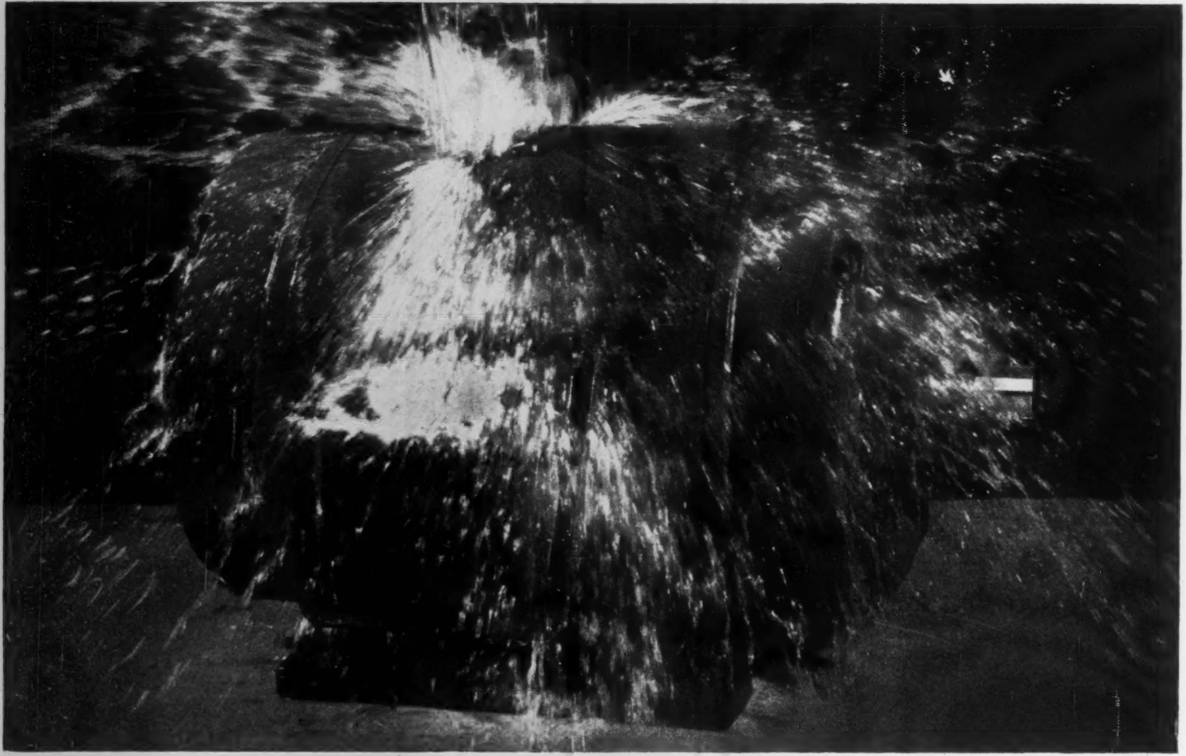
AND IS EASY TO MOVE With the aid of the Transporter, one man can easily move a RIDGID 300 Power Drive with its No. 1206 Folding Stand attached. Set-up is fast and easy. Stand's integral tool tray locks legs in position, forming rigid work base.



Save Time and Increase Your Profits on Every Job. See and Try This Biggest "Threading Machine" Bargain at your Supply House!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.



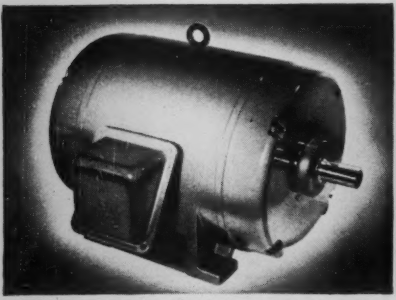
Sudden Splash or Soaking Shower

won't stop a Wagner® DP Motor . . .

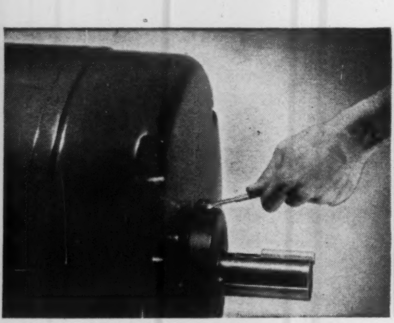
Wagner® Type DP Motors are doubly protected by rugged, corrosion-resistant cast iron frames and dripproof enclosures. Splashing or falling liquids, corrosive acids, salts, and alkalies can't stop their smooth operation. Designed to meet a wide variety of applications—including many that used to require splashproof motors—Wagner Doubly Protected Motors pack plenty of power into precious little space, are lightweight, long-lived, and pare downtime and upkeep costs to the bone. Simply put . . . they get the job done. Let your nearby Wagner Sales Engineer show you how these motors can be applied to your needs. Call him, or write for Bulletin MU-223.

Wagner Electric Corporation

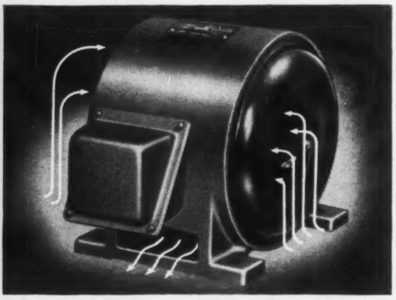
6370 PLYMOUTH AVE., ST. LOUIS 33, MISSOURI



SLEEVE BEARING MODELS AVAILABLE . . . DP Motors are built in NEMA frame sizes 182 through 445U; 1 through 125 hp—1750 RPM—40°C; available with ball bearing construction as illustrated or steel-backed, babbitt-lined sleeve bearings. Larger motors (Type RP) are available through 1000 hp.



CAN BE RELUBRICATED . . . Original factory lubrication will last for many years in normal service, but openings are provided to permit the relubrication that adds years to motor life under severe conditions.

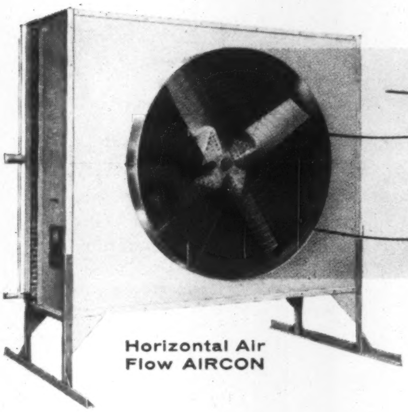


COOL RUNNING . . . Specially designed baffles direct cooling air through the motor to reduce stator temperature, thus increasing motor life. Blowers, cast as part of the rotor, move large volumes of air without noise or vibration.

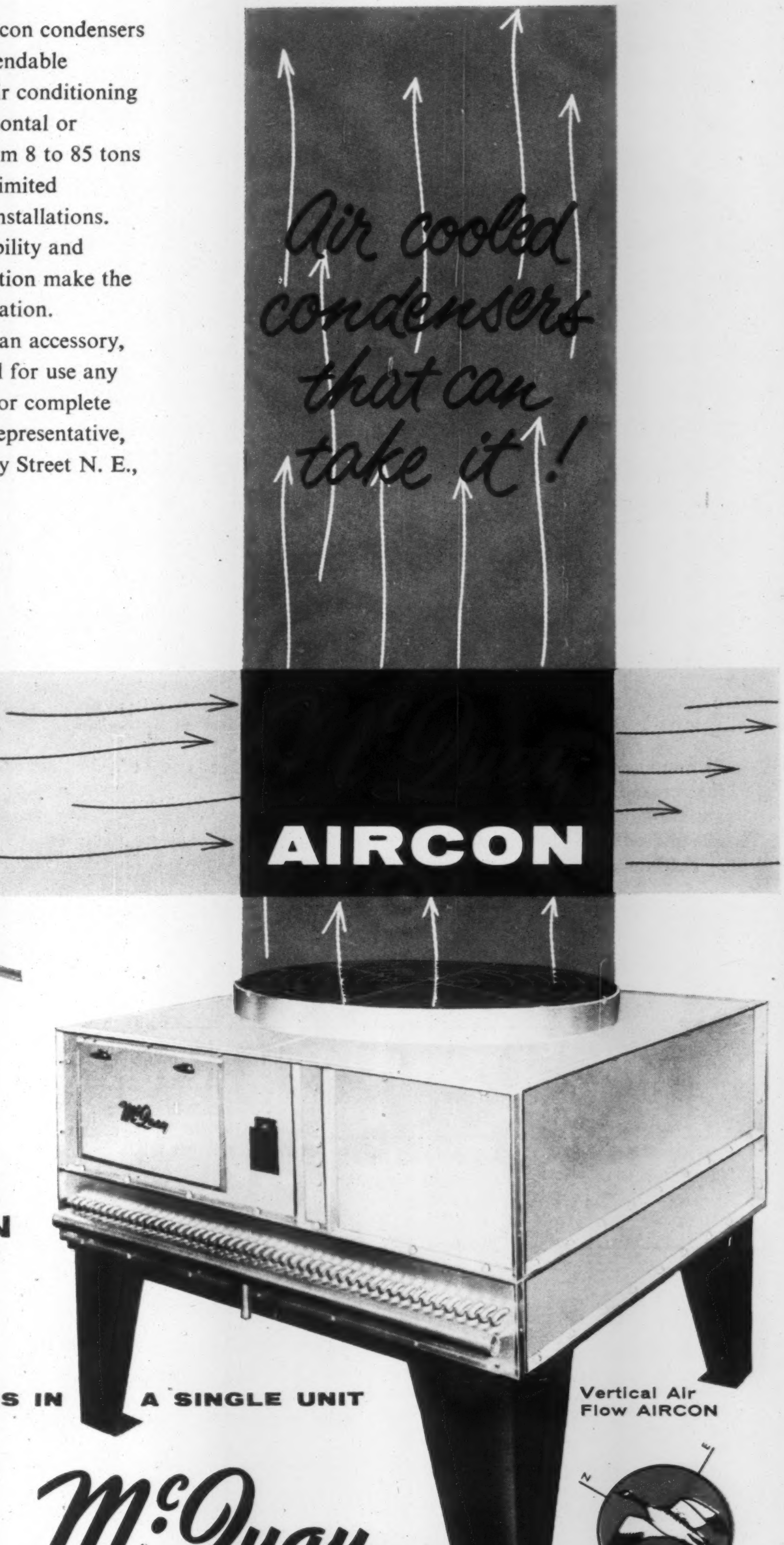
WM60-20

McQuay heavy duty, air cooled Aircon condensers are constructed to give complete, dependable operation for either refrigeration or air conditioning—or both. They are available in horizontal or vertical air flow models in 13 sizes from 8 to 85 tons nominal capacity in a single unit. Unlimited capacity is available in multiple unit installations. The low profile, quiet operation, flexibility and the economy in installation and operation make the McQuay Aircon ideal for every installation. The McQuay Seasontrol, available as an accessory, offers automatic head pressure control for use any time of the year, winter or summer. For complete information call your local McQuay representative, or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

McQuay
Means Quality



Horizontal Air Flow AIRCON



Vertical Air Flow AIRCON

for AIR CONDITIONING, REFRIGERATION OR BOTH

13 SIZES • 8 TO 85 TONS IN A SINGLE UNIT

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

POWELL
WORLD'S LARGEST FAMILY OF
VALVES
performance makes the world of difference

POWELL BRONZE VALVES

Pictured here are a few valves offered by Powell to meet the demand for good, quality Bronze Valves. All kinds are available—gate, globe, angle, check, "Y", etc.—in all required sizes—for pressures from 75 to 2500 pounds.

The Powell Line includes valves in bronze, iron, steel, corrosion-resistant metals and alloys—just the right valves in the right sizes and materials to handle every flow control requirement, whether water, oil, gas, air, steam or corrosive fluids. Consult your Powell Valve Distributor—or write to us for illustrated literature.

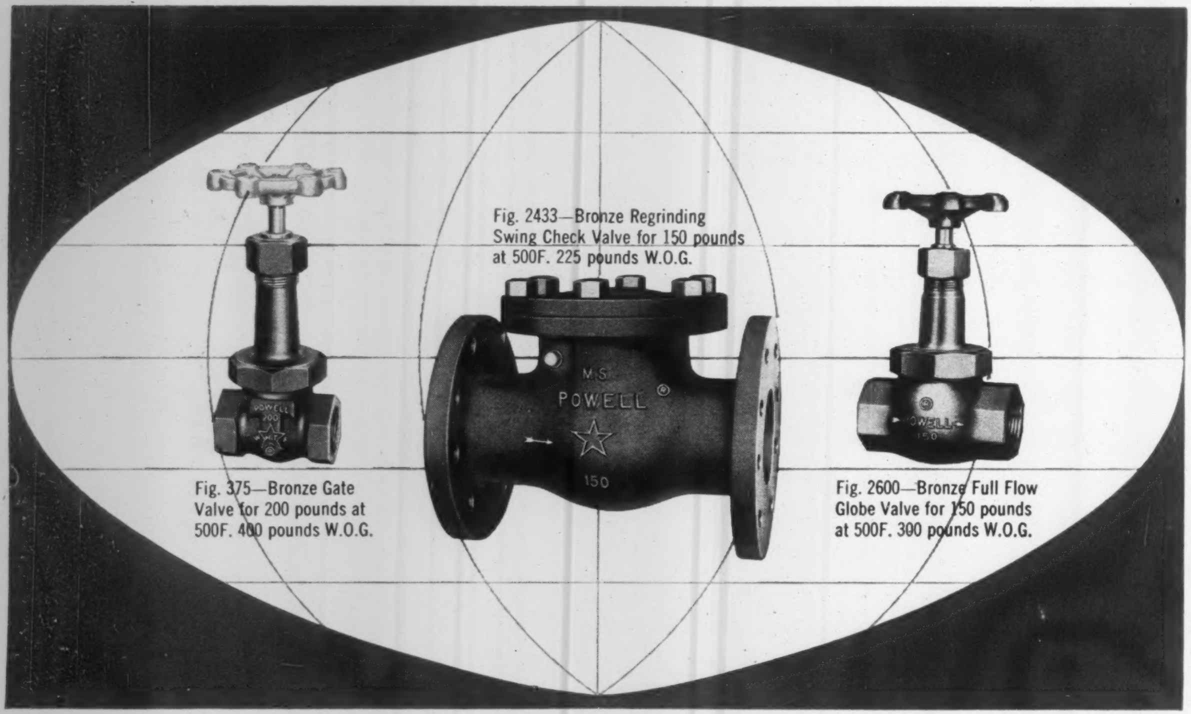


Fig. 375—Bronze Gate Valve for 200 pounds at 500F. 400 pounds W.O.G.

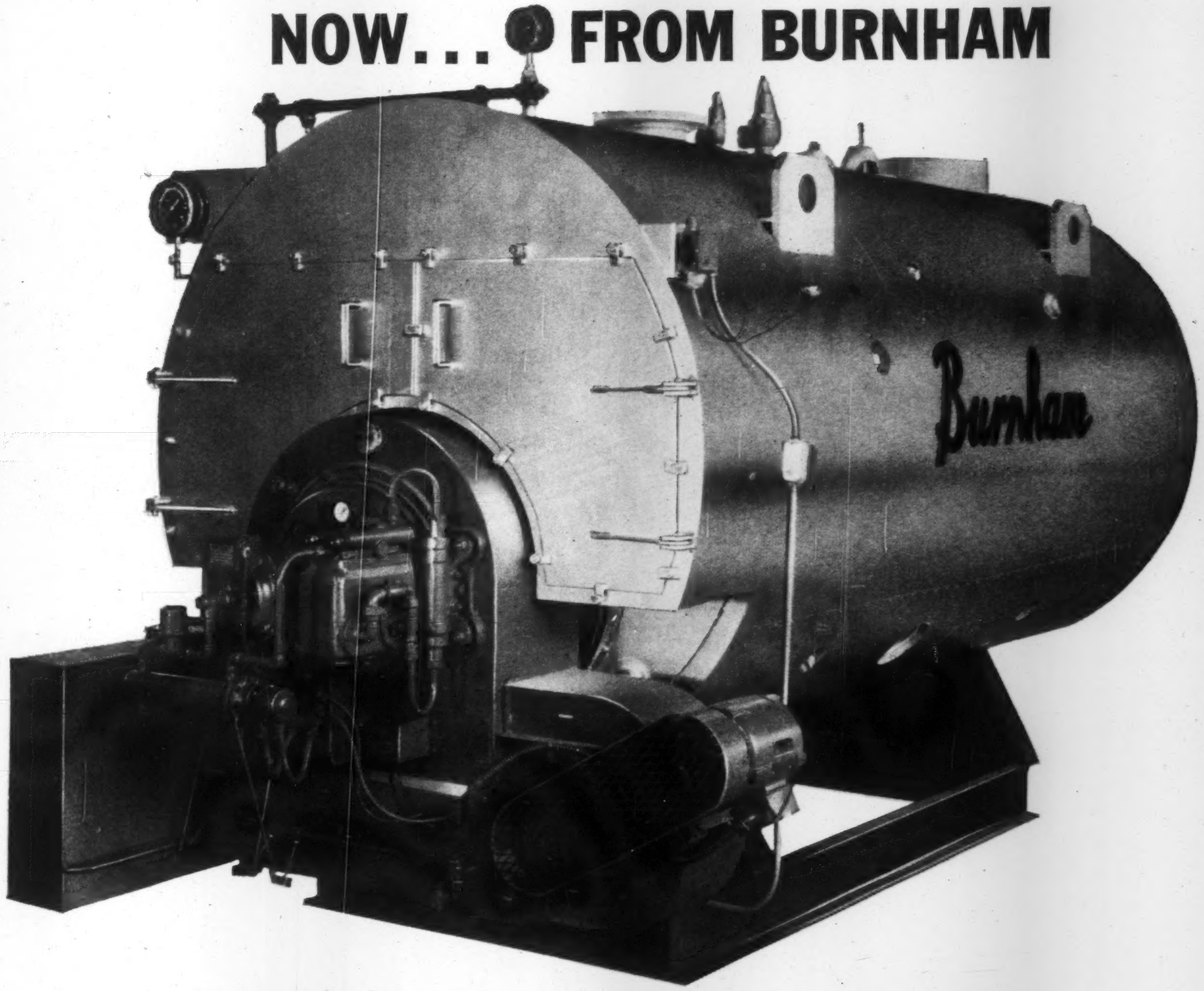
Fig. 2433—Bronze Regrinding Swing Check Valve for 150 pounds at 500F. 225 pounds W.O.G.

Fig. 2600—Bronze Full Flow Globe Valve for 150 pounds at 500F. 300 pounds W.O.G.

POWELL
200
M.S.
POWELL
150
POWELL
150

THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO

NOW... FROM BURNHAM



TO MEET TODAY'S TREND—THE NEW

3-PASS SCOTCH-TYPE PACKAGED STEEL BOILER

Here's the new Burnham 3-Pass Scotch-Type Packaged Steel Boiler that gives peak performance with minimum maintenance in commercial steel heating. These advanced-concept boilers have certified efficiencies of better than 80% and are designed to the latest SBI ratings. Flue gas temperatures are in the 400 to 450 range. Perfectly balanced draft conditions between the second and third passes help make these units outstanding performers. Available as bare boilers or as complete boiler-burner packages for oil, gas or oil/gas combination firing. Sizes from 20 to 800 hp. new five sq. ft. fireside heating surface ratings per hp. Get full details in our free catalog.

Also available for prompt shipment:
Scotch-Type 2-pass boilers; Compact-Type Table 1 and Table 2 steel boilers.

Burnham Corporation

Steel Boiler Department
Irvington, New York

MEMBER

Sales Representatives throughout the U. S. A.

Burnham Corporation HP-110
Steel Boiler Department
Irvington, New York

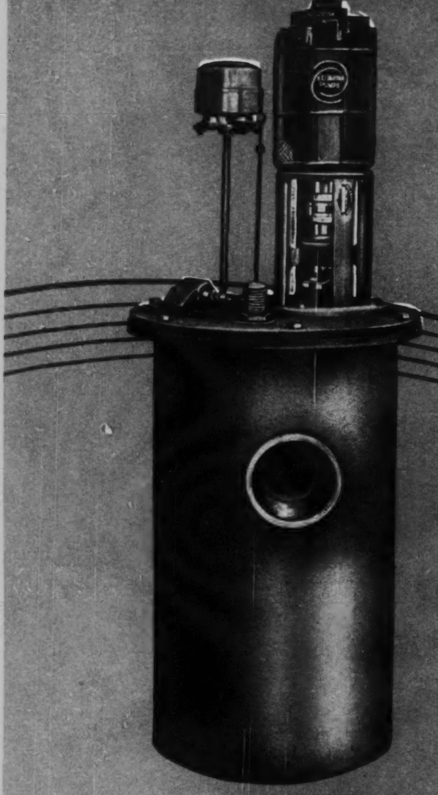
Please send me, without obligation, full ratings and data on:

☐ Scotch-Type 3-pass Boilers
☐ Scotch-Type 2-pass Boilers
☐ Compact Boilers
☐ Boiler-Burner Packages

Name ....

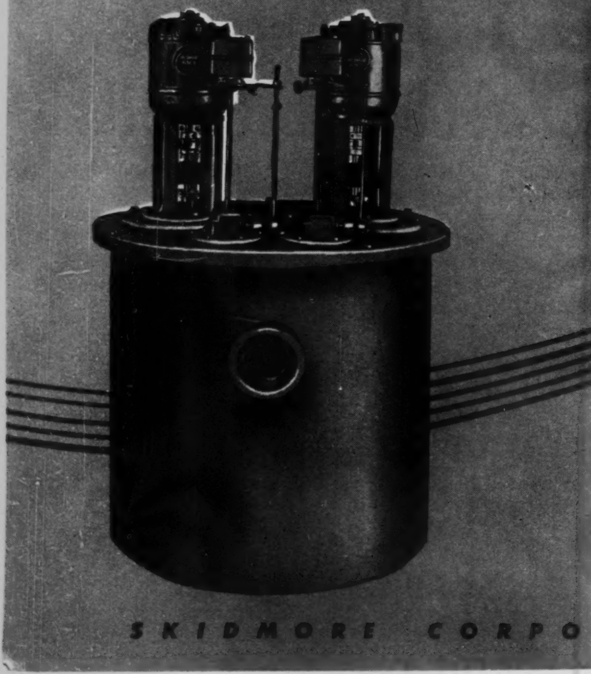
Address ....

City .... State ....



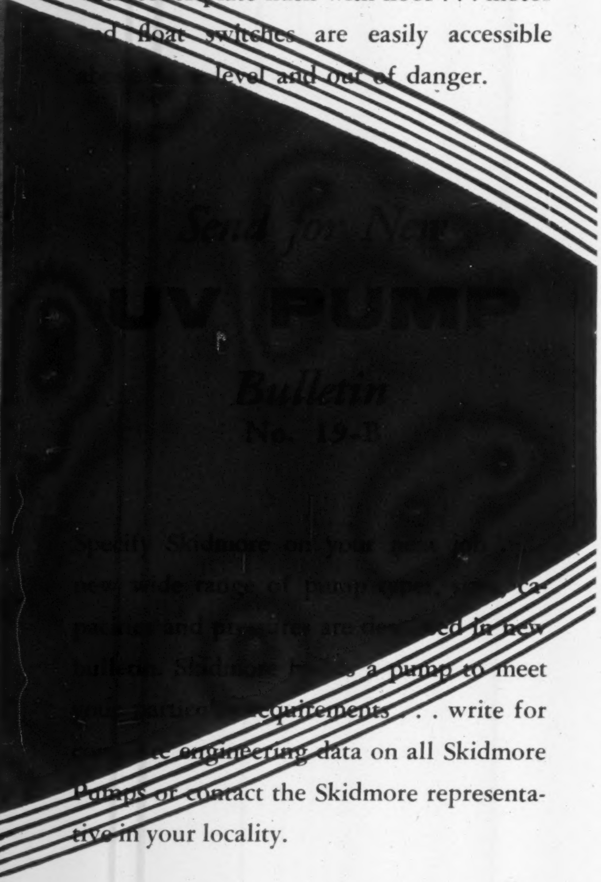
SKIDMORE SINGLE UNIT UV PUMP

SKIDMORE DUPLEX UNIT UV PUMP



SKIDMORE

Type UV condensate pump is ideal for return of condensate to the boiler or other points. Built in both single and duplex units . . . type UV pump can be installed with cover plate flush with floor . . . motor and float switches are easily accessible at [illegible] level and out of danger.



Specify Skidmore on your next job . . . new wide range of pump types, sizes, capacities and pressures are described in new bulletin. Skidmore has a pump to meet your particular requirements . . . write for complete engineering data on all Skidmore Pumps or contact the Skidmore representative in your locality.

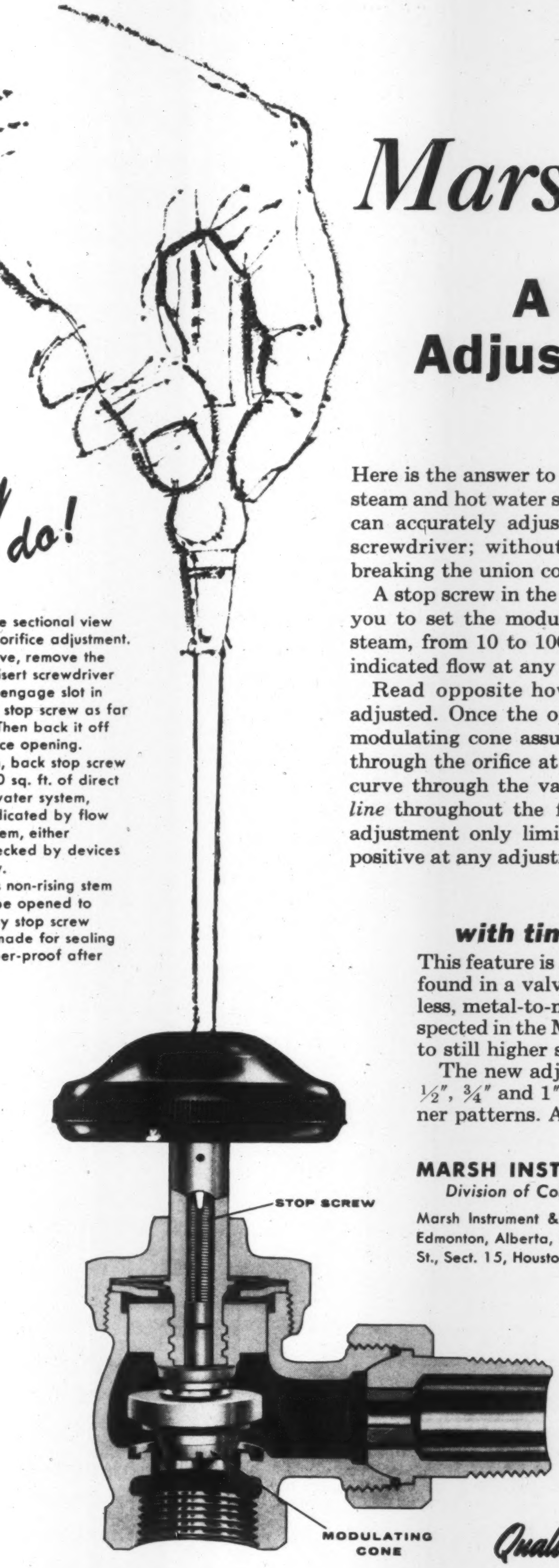
Skidmore Pumps have set a standard of performance and dependability since 1921.

S SKIDMORE PUMPS

SKIDMORE CORPORATION ST. JOSEPH MICHIGAN

Marsh Presents

A Superior Adjustable Orifice Valve



Here is the answer to easy, highly efficient balancing of both steam and hot water systems . . . a radiator valve in which you can accurately adjust orifice opening with the twist of a screwdriver; without shutting down the system; without breaking the union connection.

A stop screw in the valve stem, as illustrated here, enables you to set the modulating cone for any required flow: on steam, from 10 to 100 sq. ft. E.D.R.; on hot water, to any indicated flow at any given pressure.

Read opposite how simply and effectively the flow is adjusted. Once the opening is set, the special taper of the modulating cone assures the correct flow of steam or water through the orifice at any opening. In other words, the flow curve through the valve at *any* given pressure is a *straight line* throughout the full range of valve opening. Since the adjustment only limits the amount of opening, shut-off is positive at any adjustment without disrupting orifice setting.

A new valve with time-tried Marsh design

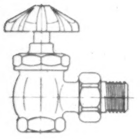
This feature is all the more significant because it is found in a valve that incorporates the truly packless, metal-to-metal seal construction so highly respected in the Marsh R-100 series and now brought to still higher standards.

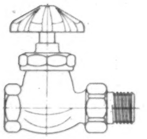
The new adjustable R-105 series is available in ½", ¾" and 1" sizes; angle, straightway, and corner patterns. Ask for special bulletin.

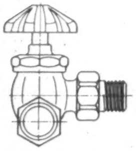
The stop screw in the sectional view below provides the orifice adjustment. Simply close the valve, remove the handle-screw and insert screwdriver in the open stem to engage slot in stop screw. Turn the stop screw as far down as it will go. Then back it off to the required orifice opening.

In a steam system, back stop screw one turn for each 10 sq. ft. of direct radiation. In a hot water system, as many turns as indicated by flow requirements of system, either precalculated or checked by devices for determining flow.

Note that valve is non-rising stem type and can only be opened to position permitted by stop screw setting. Provision is made for sealing the adjustment tamper-proof after setting orifice.


Angle


Straightway


Corner—either right or left hand

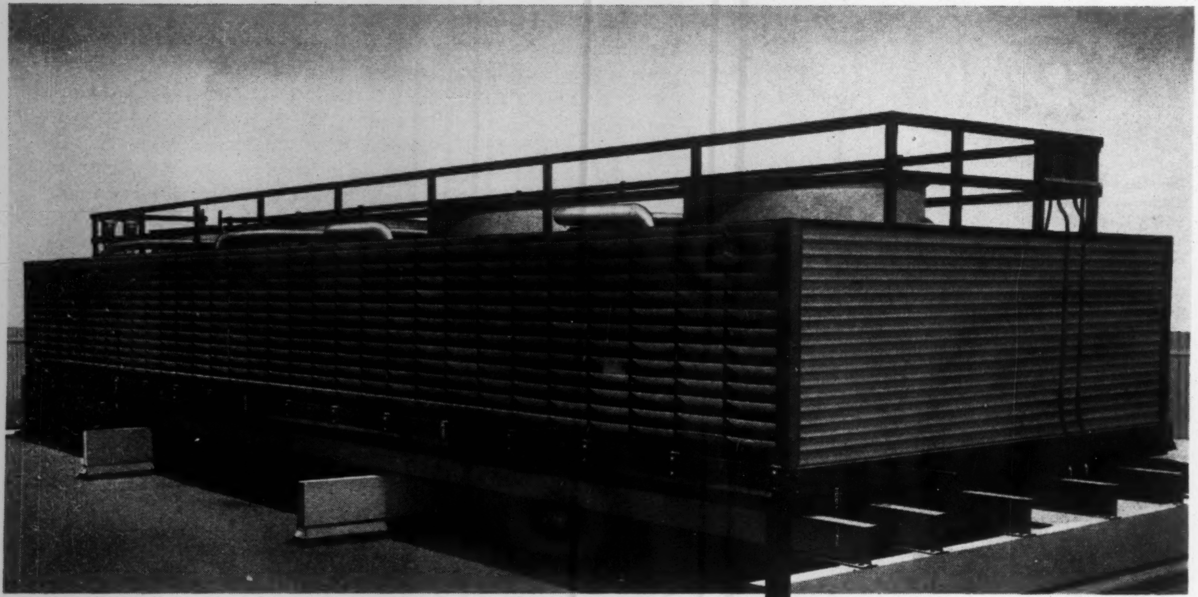
MARSH INSTRUMENT CO., Skokie, Illinois
Division of Colorado Oil & Gas Corporation, Dept. T

Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada; Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas.

MARSH

Quality Heating Specialties since 1865

FLUOR COOLING TOWERS



higher performance

lower maintenance cost

built-in permanence *

*

You'll get more cooling at lower cost, and longer tower life under all operating conditions with Fluor Cooling Towers. From heavy industrial installations to light central station air conditioning and refrigeration units, there's a Fluor Cooling Tower to meet your specific needs.

Fluor PRODUCTS COMPANY
COOLING TOWERS

A division of The FLUOR CORPORATION, Ltd.

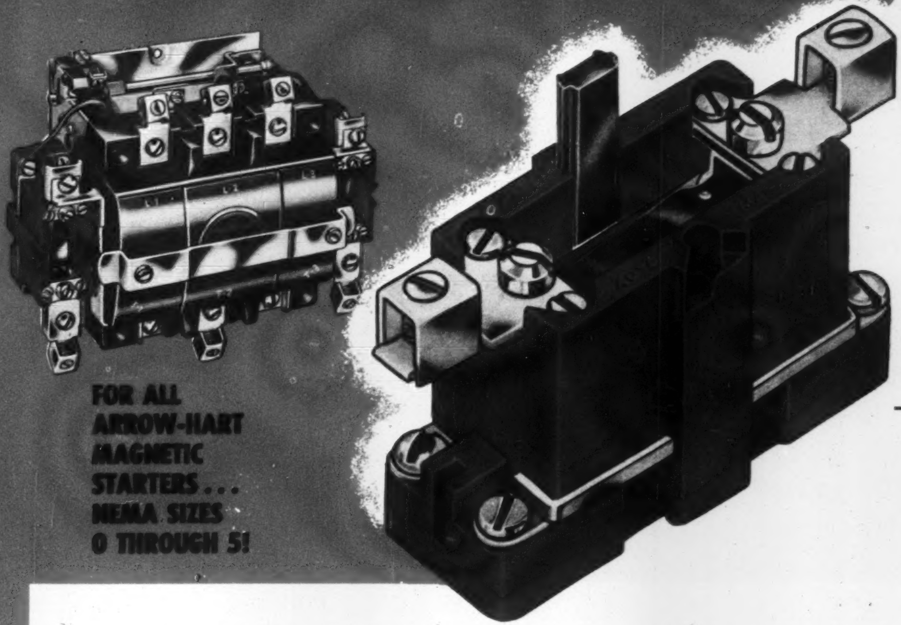
GENERAL OFFICES: P. O. Box 1267, SANTA ROSA, CALIFORNIA

ANNOUNCING

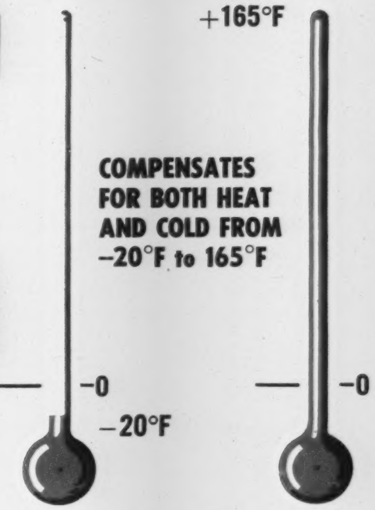
Something NEW under the sun

the ARROW (AH) HART

AMBIENT COMPENSATED OVERLOAD RELAY



FOR ALL ARROW-HART MAGNETIC STARTERS... NEMA SIZES 0 THROUGH 5!



COMPENSATES FOR BOTH HEAT AND COLD FROM -20°F to 165°F

RELIABLE AND ACCURATE PROTECTION REGARDLESS OF HEAT OR COLD

Here, for the first time, is a compact overload relay that compensates for both heat and cold, operating on the same time curve at all temperatures from -20°F to 165°F. Compensation is completely automatic. No field adjustment is needed. Operating mechanism is simple, rugged and dependable.

This performance is made possible by the exclusive Arrow-Hart "Balancing Bi-Metal" which is located in a separate compartment and is not; therefore, affected by heat applied to the working bi-metal.

- **MUCH SMALLER SIZE** . . . than any other comparable unit now available. Base size is the same as standard A-H Overload Relays.
- **USES STANDARD HEATERS** . . . and works equally well with either quick-trip or regular type.
- **COMPENSATES AUTOMATICALLY** for both heat or cold, by means of an exclusive, "Balancing Bi-Metal" Effective through a temperature range from —20°F to 165°F.
- **DEPENDABLE IN OPERATION** . . . and requires no adjustments of any kind.
- **AVAILABLE** . . . with all A-H Starters. Ratings from 25 to 300 amperes, continuous current. Normally supplied with manual reset. If desired, relays can be equipped with a change-over lever that provides manual or automatic reset, as required.

IDEAL FOR USE . . .

OUTDOORS . . . in oil fields and other installations subjected to wide seasonal or daily changes in ambient temperatures.

INDOORS . . . for control installations located near boilers, furnaces, heating units or refrigeration equipment and subjected to wide daily changes in ambient temperature.

SEE NEXT PAGE FOR CONSTRUCTION DETAILS and ADDITIONAL DATA . . .

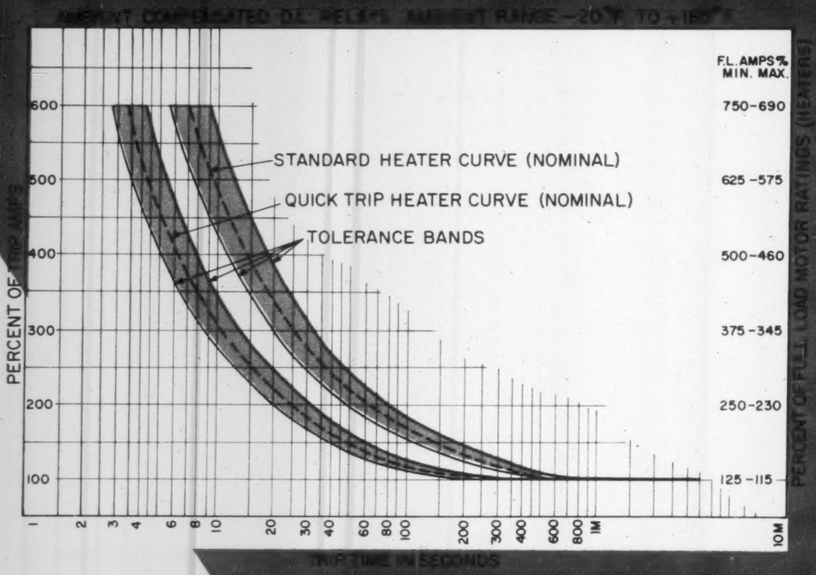
THE ARROW-HART & HEGEMAN ELECTRIC CO., HARTFORD 6, CONNECTICUT

AMBIENT COMPENSATED OVERLOAD RELAYS

WITH "BALANCING BI-METAL"

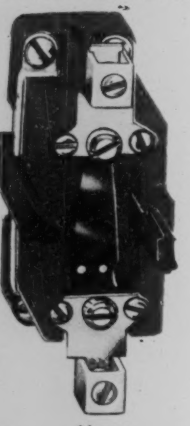
DEPENDABLE, AUTOMATIC COMPENSATION for A WIDE RANGE OF TEMPERATURE CHANGES

As shown in the accompanying drawing, the working bi-metal and the compensating bi-metal are identical in size and construction and are joined by a coupling bar. As the ambient temperature rises above 72°F, the compensating bi-metal operates through the coupling bar to move the working bi-metal in order to maintain its distance from the trip arm. Similarly, as the ambient temperature falls below 72°F, the compensating bi-metal operates to maintain its distance from the trip arm. Therefore, tripping time remains the same regardless of temperature. Switching mechanism itself employs the same positive snap-action featured in all Arrow-Hart Overload Relays. The calibrating screw permits precise setting. This screw is set and sealed at the factory and requires no further adjustment.

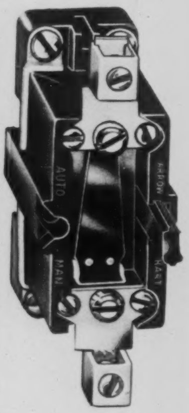


SEND NOW FOR COMPLETE INFORMATION

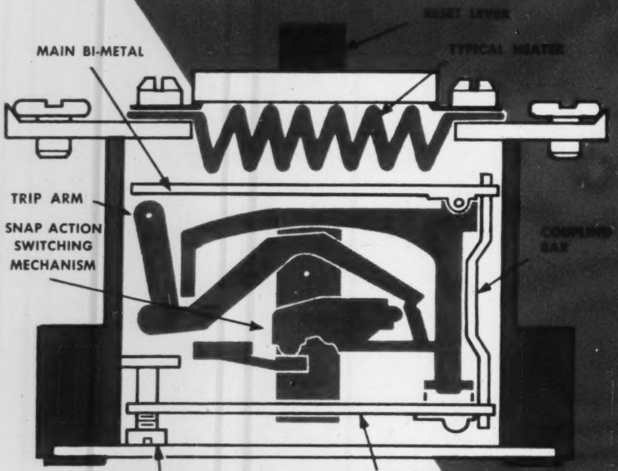
COMPARABLE IN SIZE TO STANDARD ARROW-HART O.L. RELAYS



New Ambient Compensated O.L. Relay



Standard O.L. Relay


RESET LEVER
TYPICAL HEATER
MAIN BI-METAL
TRIP ARM
SNAP ACTION SWITCHING MECHANISM
COUPLING BAR
CALIBRATING SCREW FACTORY SET AND SEALED
COMPENSATING BI-METAL

PATENT NO. 2,908,786

OPERATES ON THE SAME TIME CURVE AT ALL TEMPERATURES FROM —20°F TO 165°F!

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
103 Hawthorn Street, Hartford 6, Connecticut
MOTOR CONTROL DIVISION

Please send me complete information on the new Arrow-Hart Ambient Compensated Overload Relays with exclusive "Balancing Bi-Metal" Mechanism.

name ____________________

position ____________________

company ____________________

co. address ____________________

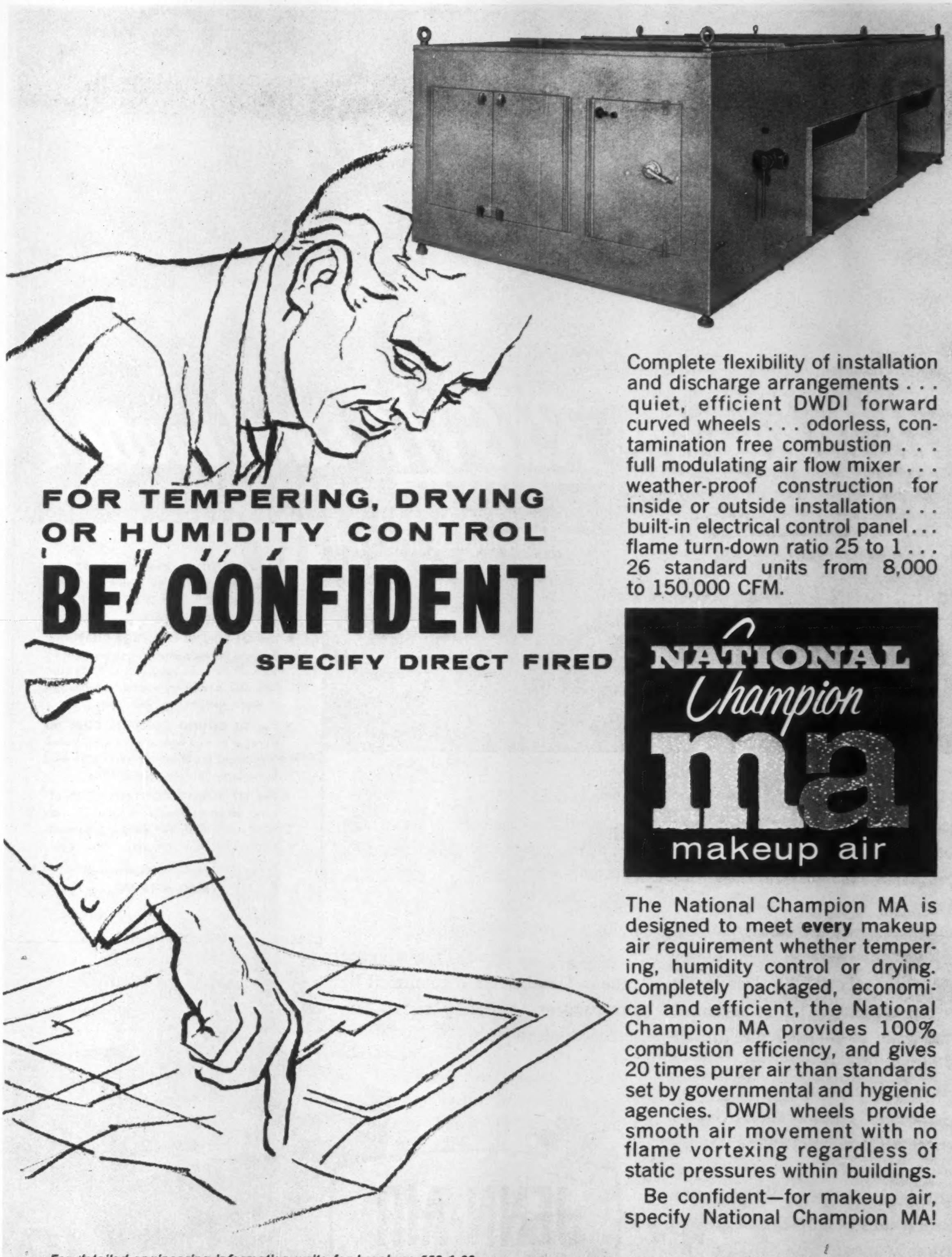
city __________ zone _____ state __________

ECM

ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES



FOR TEMPERING, DRYING OR HUMIDITY CONTROL

BE CONFIDENT

SPECIFY DIRECT FIRED

Complete flexibility of installation and discharge arrangements . . . quiet, efficient DWDI forward curved wheels . . . odorless, contamination free combustion . . . full modulating air flow mixer . . . weather-proof construction for inside or outside installation . . . built-in electrical control panel . . . flame turn-down ratio 25 to 1 . . . 26 standard units from 8,000 to 150,000 CFM.

NATIONAL
Champion
ma
makeup air

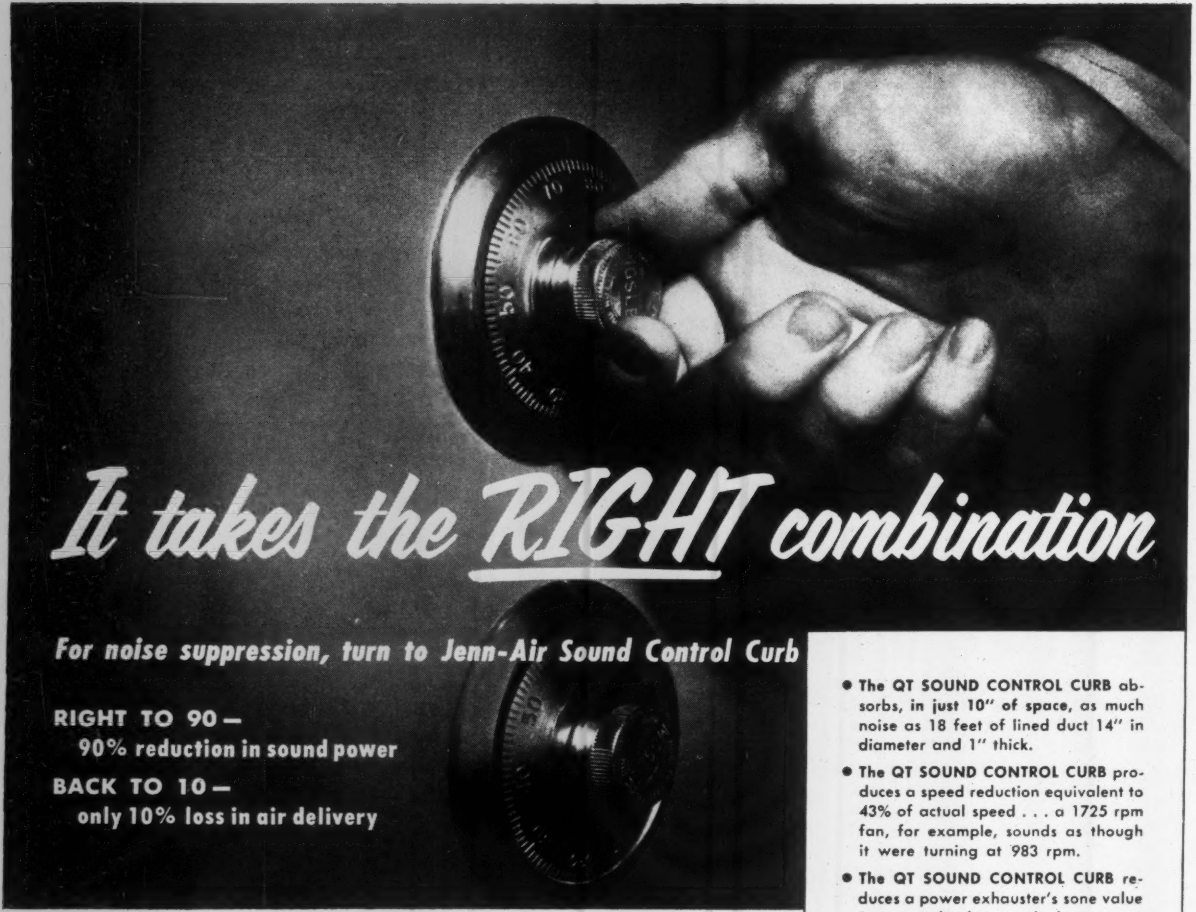
The National Champion MA is designed to meet **every** makeup air requirement whether tempering, humidity control or drying. Completely packaged, economical and efficient, the National Champion MA provides 100% combustion efficiency, and gives 20 times purer air than standards set by governmental and hygienic agencies. DWDI wheels provide smooth air movement with no flame vortexing regardless of static pressures within buildings.

Be confident—for makeup air, specify National Champion MA!

For detailed engineering information write for brochure 552-1-60

NATIONAL HEATER COMPANY, INC.
2475 DOSWELL AVENUE • ST. PAUL 8, MINNESOTA

UNITS ON DISPLAY AT PLANT MAINTENANCE AND ENGINEERING SHOW JANUARY 23-26, AND INTERNATIONAL HEATING AND AIR CONDITIONING EXPOSITION FEBRUARY 13-16.



It takes the RIGHT combination

For noise suppression, turn to Jenn-Air Sound Control Curb

RIGHT TO 90 —
90% reduction in sound power

BACK TO 10 —
only 10% loss in air delivery

- **The QT SOUND CONTROL CURB** absorbs, in just 10" of space, as much noise as 18 feet of lined duct 14" in diameter and 1" thick.
- **The QT SOUND CONTROL CURB** produces a speed reduction equivalent to 43% of actual speed . . . a 1725 rpm fan, for example, sounds as though it were turning at 983 rpm.
- **The QT SOUND CONTROL CURB** reduces a power exhauster's sone value (apparent loudness to the human ear) by approximately two-thirds.
- **The QT SOUND CONTROL CURB** offers effective noise control in an easily-installed, self-flashing, prefabricated curb.

Leader in functional IMAGINEERING . . .

The "right combination" in power exhauster curbs is (1) effective noise suppression *plus* (2) high air delivery. Only *one* unit provides both! The Jenn-Air QT Sound Control Curb reduces exhauster sound power 90% with only a 10% loss in air moving capacity! This achievement is the result of unique Jenn-Air patent-protected design features.

Both "right combination" factors deserve equal consideration from the engineer. Good attenuation ratings are worthless if achieved at the expense of air delivery. By the same token, claims of unrestricted air flow probably mean that little or no attenuating ability can be expected.

Get *all the facts* before you specify . . . prove to yourself that Jenn-Air's QT Sound Control Curb represents a major breakthrough in the field of noise control for power roof ventilation. The QT curb's performance ratings (see box) are confirmed by independent laboratory tests—data available on request.

JENN-AIR

JENN-AIR PRODUCTS COMPANY, INC. 1102 Stadium Drive · INDIANAPOLIS 7, INDIANA
Member Air Moving & Conditioning Association

you'll want to know . . .

2500 Ton Cooling System Keeps Vital Defense Efforts Moving

ONE OF THE BIGGEST comfort air conditioning systems west of the Mississippi has passed its first big heat test. Blistering summer temperatures of 115 F in the San Fernando Valley were overcome by the 2500 ton cooling system of the R & D Facility of Thompson Ramo Wooldridge Inc., according to the Recold Corp.

R & D is a defense installation primarily engaged in research and development of complex electronic and aerospace systems. The seven-building facility sits against foothills on a 90 acre site at Canoga Park, Calif. A total of 383,500 sq ft of space requires cooling.

A central cooling plant with a fan-coil distribution system was devised to furnish air conditioning on schedule in any volume to any part of the complex. Guaranteed sources of supply and centralized controls assure absolute reliability.

Two 100 × 200 ft spray cooling ponds, with a combined capacity of 330,000 gal of water, are used for heat rejection. The pools are located in a mall at the upper level of the four level terraced site. Each pool has 120 1½ in. heads, bunched in 20 clusters of six heads each.

The condenser water system passes water through the heads to be sprayed into the air in mist form and cooled down to a range of 89 to 94 F.

The water is chilled to 40 F by 12,400 lb of refrigerant in two giant compressors. It is piped underground to the buildings, then returned at approximately 45 F to be re-chilled.

Air passes over the coils in parallel, rather than in series, and enters the double-duct system to be distributed under medium pressure at 2400 fpm.

Diffusers are 6, 8, and 10 in. in diameter and deliver from 200 to 400 cfm.

The central heating and air conditioning units are housed in an 18,500 sq ft structure of tilt-up concrete. From this center, conditioned water flows to all units of the facility.

Each of the seven structures is

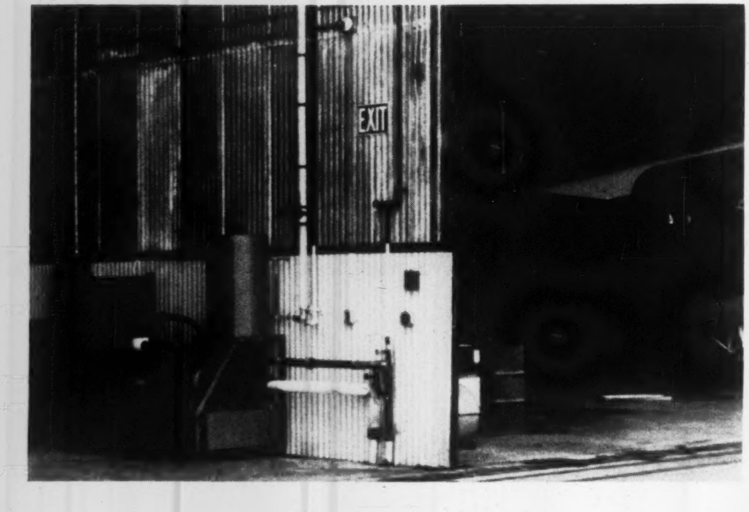
serviced by six 35,000 cfm air handling units, with a total capacity of 1,470,000 cfm.

Ten percent outside air is introduced into the system at all times, and the balance is recirculated.

The engineers, while challenged by the high and extended heat problems of the area, had no humidity problems per se. So no attempt was made to control humidity.

Allowance was made in the central plant for the addition of two compressors. The mall also was designed to accommodate an additional spray pond. When fully developed, the total cooling capacity of the system will be 5000 tons.

A. C. Martin & Associates, architects and engineers, designed the facility.



Hangar Door Heater Speeds Executive Flights

FROZEN HANGAR DOORS won't prevent fast take-offs this coming winter by the executives of a large manufacturing firm in New York. A 48 kw, 160,000 Btu per hr fluid heat transfer unit has recently been installed to keep the doors rolling in the coldest of weather, according to the Hynes Electric Heating Co.

The unit connects with piping embedded in the concrete just under the hangar door rails. Four lines of 1½ in. Schedule 40 steel pipe beneath the rails form a pipe coil through which hot oil is introduced and circulated.

Used only when icing conditions are prevalent or predicted, the unit heats the oil to 85 F, enough to keep the temperature of the rails and adjacent areas well above the freezing point. The heater keeps the oil recirculating through the system at the proper temperature.

OHI Sponsors Oil Heat Smoke Emission Study

A COMPLETE STUDY of smoke and its chemical composition arising from the operation of oil burners is now under way at Michigan State University, according to the Oil Heat Institute of America.

"The lack of specific and exact data on this subject has seriously handicapped the oil heating industry in the presentation of cases before public bodies in defense of the use of oil burning equipment." OHI's managing director, Charles H. Burkhardt said. It is felt that the results of the research project will provide this information.

The studies will continue for a year or more, utilizing the services of doctorate students under the direction of Charles Pesterfield, professor of mechanical engineering at the University. Prof. Pesterfield is also technical secretary of the commercial-industrial section of the Manufacturer's Div. of the OHI, and chairman of the Oil Burner Committee of the Air Pollution Control Association.

It is expected that Ph.D. theses outlining the development and results of the studies will be published at a later date.

Council Formed To Develop Pipefitter Apprentice Training Program in Calif.

THE DEVELOPMENT of a statewide training program for apprentices and journeymen is the task of a recently formed joint training council composed of members of the Refrigeration and Air Conditioning Contractors of California and representatives of the United Association.

The council has been authorized to outline the purposes and goals of the training program. When formulated, the plan will be submitted to both labor and management groups for their consideration.

Temporary officers of the council are James Scatena of Scatena-York Corp., chairman, and Gene Ballard, business manager of Branch Local Union 250, UA, Los Angeles, secretary.

Unitary Shipments Up 15 Percent in First Half of 1960

Manufacturers' shipments of unitary air conditioners reported to the Air-Conditioning and Refrigeration Institute for the first six months of 1960 totaled 185,474 units, excluding coils. This represents a gain of approximately 15 percent over the same period for last year.

First quarter gains showed only a 10 percent gain, but second quarter figures boosted the total to the 15 percent mark, according to ARI.

The shipment figures include unitary heat pumps, but not room air conditioners.

Self-contained unitary heat pumps shipped in the first six months of 1960 totaled 13,261 units, a gain of 35 percent over the 1959 figure.

California Contractors Adopt "Rules of Practice" for Plan Check

A set of six "rules of practice" for heating, ventilating, and air conditioning contractors has been adopted by the Refrigeration and Air Conditioning Contractors Association of Southern California. The rules pertain to plan checks of system installations, Henry B. Ely, executive secretary, has reported.

The methods of procedure are designed to meet requirements for the plan check of the heating, ventilating, and air conditioning code of the city of Los Angeles. They also have been approved by the Los Angeles Chapter of the American Institute of Architects and the Consulting Engineers Association of California, Mr. Ely said.

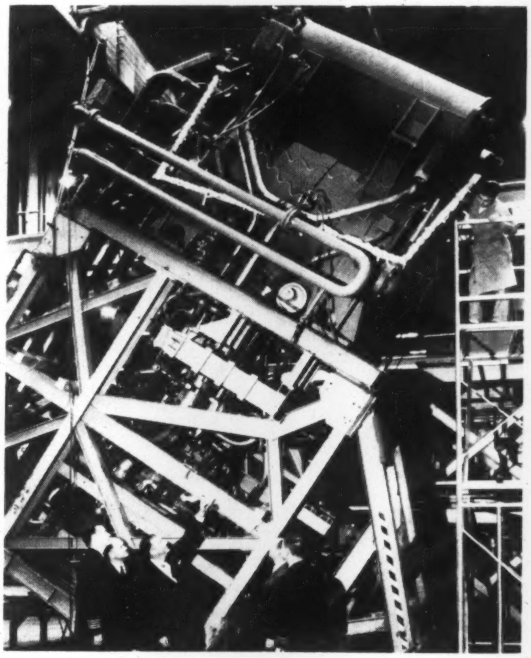
Adopted in the "rules of practice" are six basic steps which air conditioning contractors are advised to follow:

1 — The plans and specifications for heating, ventilating, and air conditioning should, so far as possible, be in one section or part for ease in obtaining approval by the Department of Building and Safety through the plan check, and for bidding.

2 — It is desirable that the plan check be obtained prior to the requesting of bids for the work, but if this is not practicable, the plan check should be obtained before bids for the work are submitted, and appropriate addenda circulated should the plan check require any deviations from the original plans and specifications.

3 — If the plan check is not obtained prior to the receipt of bids for the work, and if there

Cool Atom Sub With Steam



A cooling machine for air conditioning "the most effective anti-sub weapon ever conceived" has been shipped to a New York shipbuilder. The unit is for the attack submarine, Pollack, according to the Carrier Corp.

The machine is an adaptation of the steam-activated absorption refrigerating units developed for big building air conditioning during the mid 1940's. It uses steam from the nuclear reactor.

The small number of moving parts makes the machine quiet in operation, a Carrier official stated. Sonar and other sound detecting devices have made this feature essential.

The new cooler will produce capacities ranging from 100 to 200 tons, depending on fluctuating operating conditions. It will handle the heat generated by Pollack's 88 man crew, operating machinery, and cooking and laundry facilities.

The unit is capable of withstanding high shock resulting from depth charges or recoil after missile-firing.

At left, unit is undergoing a simulated seaworthy trial. It must be able to continue operations while pitched as much as 30 deg.

you'll want to know

are any additions or deductions to the plans and specifications as a result of the plan check, then there shall be negotiations between the low bidder and the owner's representative prior to the award of the contract.

4 — If the bid has been accepted and the contract awarded but plan check approval has not been obtained, any changes required by the plan check are an addition or deduction within the meaning of the contract.

5 — The plan check of plans and specifications can be a success only if the plan check is prompt, reasonable in cost, and accurately advises the owner of the requirements of the code.

6 — Members of the industry should make appropriate arrangements for compiling information in regard to the operation of the plan check as to the following:

(a) The time elapsed from the filing of the plans and specifications to the time of completion or when changes or revisions are indicated by the Department.

(b) Additional costs assessed by the Department at the rate of $5.00 per plan hour over and above the original charge for the plan check.

(c) Changes required by the inspector after plan check.

Mr. Ely explained that the recommended regulations were developed by the association as a means of aiding contractors by establishing protective guidelines with respect to the plan check requirements.

"Base Bid with Alternate" Spec Yields High Quality, Low Cost

ALTHOUGH no formal conclusion was reached, this seemed to be the opinion of panel members answering the question, "What type of specification produces the highest quality at the lowest cost?"

Representing the owner's viewpoint, E. L. Walls, project engineer, Monsanto Chemical Co., said three factors should be considered carefully in preparing plans and specifications for any construction project. The first one is the capital investment to be made by the owner and how it is to be amortized. Second, the importance of operating cost needs to be emphasized so as to determine this phase of the design requirement. Third, the maintenance costs are of utmost importance, he said.

He was speaking at a meeting last month of the Illinois chapter of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers in Chicago.

Mr. Walls suggested that the plans should contain as many of the requirements as possible, which in turn will shorten the specifications. Such complete drawings will also minimize the need for shop drawings by the contractor.

In preparing specifications so as to state the quality of the products to be installed, Mr. Walls said the term "or equal" should be replaced with "or approved." He also suggested the use of a standard specification form in which all the design requirements could be tabulated.

A disadvantage of a closed specification, said Mr. Walls, is that later developed items of equipment may not be used to full advantage.

Representing the consulting engineer viewpoint, Robert G. Burkhart explained the various types of specifications, and said that a "closed" specification makes it possible for the contractors to bid on the same basis. However, he said a closed specification should have an alternate tender clause.

Mr. Burkhart suggested that contractors be selected from an approved bidders list in order to assure a quality installation. He also advocated the desirability of using a separate mechanical contract to increase the quality of the installation.

The contractor view was presented by Elliot Gage, Hunter Clark Ventilating Systems Co. He felt that the contractor could serve his customers best if the base bid type of specification is prepared by the consulting engineer. He pointed out that this type of specification tells the contractor what is wanted and basically what the cost of the equipment used will be. However, he did favor the opportunity to submit alternates to the engineer for approval.

W. W. Quitmier, Vesco, Inc., manufacturers' representative, spoke on the supplier viewpoint. He favored the use of the base bid type of specification with alternates and suggested that the contractor be encouraged to submit alternates. He stressed the importance of using a uniform bid form to place the bidding procedure on a fair and uniform basis. This is another way in which the owner will get a better job for lowest cost, he said.

In a question from the floor following the panel presentations, it was pointed out that the so-called "murder" clauses in specifications are tantamount to guarantees of the system on the part of the installing contractor.

Air Conditioning Pays for Itself

Time lost and lowered productivity during hot weather account for losses of more than $100 per man a year in the average industrial plant, according to a survey made by Engineers, Inc., an industrial engineering and consulting organization.

The survey showed that $70 to $220 is lost per man, during hot weather when air conditioning is not used. The mean figure is $108 per man.

More work breaks, later starting and earlier stopping for machines, and total shutdowns occurred on hot days, the report showed. Some correlation between hot weather and increased number of accidents, equipment damage, and production rejects, was found.

The study was conducted among a cross-section of light manufacturing and assembly plants in metropolitan New York. Both office and factory personnel were considered. Performance records were made for temperatures above and below 71 F, the figure set up by the American Society of Heating and Air-Conditioning Engineers as the optimum efficient working temperature in the area.

Conversely, it was found in a survey made by the General Services Administration that air conditioning resulted in a 9.5 percent increase in work production and a 2.5 percent decrease in absenteeism. The GSA study points out that a work production increase of 1.5 percent will pay for the cost of air conditioning. The complete report of this study appeared in the June 1959 HPAC, pages 112-115.

Ash Removal System in Institution Eliminates Time-Consuming Operations

The removal of boiler ash and flyash is no longer a problem at Our Lady of Fatima Institute, a home for children in Elmhurst, Pa. A system has been installed that eliminates many of the burdensome operations previously necessary for this task, according to The Allen-Sherman-Hoff Co.

At the time the Institute installed two new boilers and an auxiliary water heater, an ash removal system specifically designed for small plant application was also installed.

Prior to conversion, removal of ash was a real problem. It had to be shoveled into tote cans, carted to the bottom of a stairwell, and then hoisted by pulley to ground level where it was stored until disposal.

With the new system, the ash is raked from the boiler ash pit onto a flat anvil plate. An opening in the plate leads to a vacuum pipe that draws the ash through the boiler room piping, up a vertical line to a special steel silo erected on ground level. Discharge is made into a primary ash collector and a secondary collector atop the silo.

The ash drops by gravity from these collectors into the silo. The conveying air passes through a bag filter before it enters the suction of the exhauster and is discharged to atmosphere. This insures that no dust, however fine, enters the exhauster.

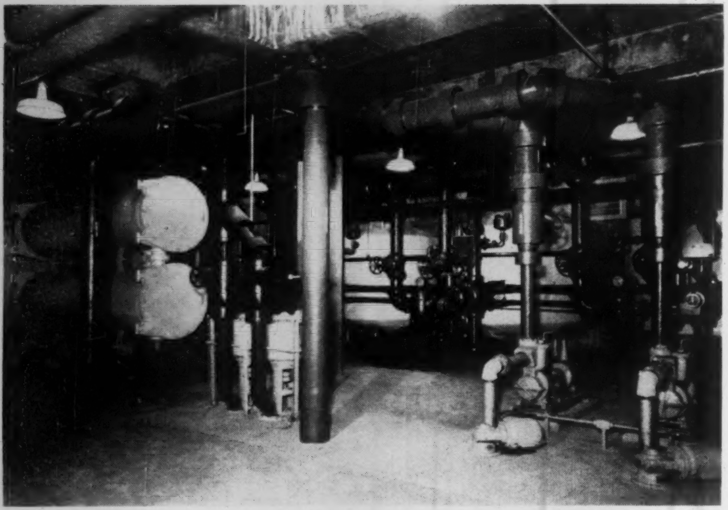
The silo will provide about 15½ days storage for ash. (The two boilers and heater produce about 1540 lb of ash per day.) It has water nozzles at the silo discharge gate for wetting the ash prior to discharging through the manually-operated gate into a disposal truck.

Large 10-Car Infrared Thawing Installation Planned

One of the largest electric infrared ore car thawing installations will be built by Radcor, Inc., according to Bruce Fleming, vice president of Radcor's parent firm, the Edwin L. Wiegand Co.

The installation will be made in the Chicago and North Western Railway Co.'s new ore car thawing facility at Escanaba, Mich. When completed, 10 seventy-ton ore cars may be accommodated at one time.

The infrared heating elements will have an input of 5000 kw and be installed in long banks at the bottom, sides and top of the 276 ft tunnel-like structure.



Laundry Waste Water Supplies 18 Million Btu's to Hospital

TWO HEAT EXCHANGERS designed to reclaim 18 million Btu per hr from laundry waste water have been installed at the Wayne County General Hospital and Health Center in Eloise, Mich., according to the Patterson-Kelley Co., Inc.

Installed as a unit for series operation, the two closed-type reclaimers increase the temperature of 600 gpm of fresh water from 40 to 100 F when supplied with 750 gpm of waste water at 130 F.

Each reclaimer measures 13 ft. 6 in. long, with a shell diameter of 37 in. and a flange diameter of 43.5 in. OD. Each has a total heating surface of 3000 sq ft of $1\frac{1}{4}$ in. OD seamless drawn copper tubing.

Both reclaimers are equipped with two centrifugal waste water screening devices to eliminate solids from the entering water.

Pipe for Nuclear Service To Be Exhibited

THE LATEST developments in piping and its allied products will be on exhibit at the 24th National Exposition of Power and Mechanical Engineers, Nov. 28 through Dec. 2, in the New York Coliseum.

The biennial exposition is held under the auspices of The American Society of Mechanical Engineers in conjunction with its winter-annual meeting.

One of the many displays will feature centrifugally cast, heavy-walled pressure piping for nuclear service. This is the first of its kind, authorized under a recent interpretation of the ASME Code for Pressure Piping.

Other important displays will include:

—A high temperature, high pressure alloy and carbon steel pipe specifically designed for electric generating stations.

—Various exhibits of piping, fittings and valves, along with meters, flow and level indicators, separators, traps, mixing valves, feeders, and other liquid and gas moving equipment.

—A new design system for intricate and extensive piping layouts, using electronic computation.

—A line of purifiers for removing liquid and solid entrainment from steam and air in pipe lines.

—Equipment for the installation and maintenance of piping.

The Exposition will not be open to the public. Admission will be by invitation and registration only.

Establish Fund To Honor Dr. A. C. Willard

AS A PERMANENT TRIBUTE to Dr. A. C. Willard, a Lectureship and Student Grant Fund has been established in the University of Illinois Foundation. Dr. Willard was president emeritus of the University and recognized as a prominent heating, ventilating, and air conditioning engineer, professor, and administrator.

A committee is being organized to establish the fund, and Dr. Roger Adams, professor of chemistry emeritus, will be chairman. Arrangements have been made whereby tax deductible contributions can be made direct to the University of Illinois Foundation, Room 224, Illini Union Building, Urbana, Ill.

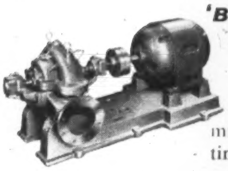
History of Air Pollution Control Given in 10 Year Progress Report

TEN YEARS of technical progress in the control of stationary sources of air pollution are reviewed in a new report recently made available by the Air Pollution Control District, County of Los Angeles.

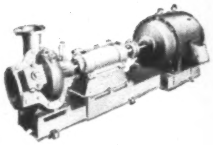
The first of four volumes, the report is entitled "Control of Stationary Sources" and sums up the technical advances made by the APCD in the past decade.

This first volume, No. 1, was prepared under the direction of Robert L. Chass, APCD director of engineering. Other volumes in preparation are: "Air Quality of Los Angeles County," "Chemistry of Urban Atmosphere," and "The Automobile and Smog — a Status Report."

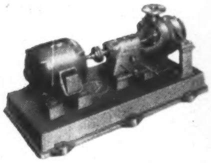
BUILT FOR THE JOB ...TO SAVE YOU MONEY



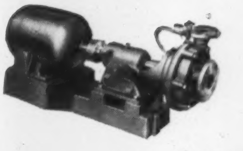
'Buffalo' Clear Water Pumps. These Double Suction Pumps are designed for maximum efficiency in clear water service. Ruggedly built for long, trouble-free life with minimum down-time. Write for Bulletin 955.



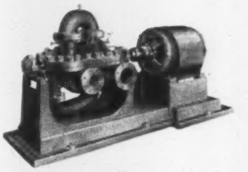
Non-Clogging Pumps. Move high consistency liquids efficiently and dependably. Wear and wedging are minimized. Diagonally split shell simplifies inspection. Rubber-lined units are ideal for corrosive or abrasive liquids. Full details in Bulletin 953.



Heat Transfer Pumps. Specially engineered to handle high temperature liquids. Huskily built with special alloys, water-cooled bearings and suitable packings. Highly efficient single suction, solid shell design. Write for complete details.



'Buffalo' Chemical Liquid Pumps. These sturdy pumps are specially engineered for punishing service in moving most corrosive, abrasive or high consistency liquids. Your choice of several types in a wide variety of trim. Send for Bulletin 976.



High Pressure Pumps. These multi-stage pumps stand up under boiler feed and other severe clear water conditions. Designed to operate against heads as high as 1500 ft., in capacities to 900 gpm. Bulletin 980 gives complete facts.

Close-Coupled Pumps. These space-saving 'Buffalo' Pumps combine high efficiency with great compactness. Since no shaft alignment is required, installation is simplified. Models for vertical or horizontal installation. Discharge is adjustable to required angle. Send for Bulletin 975.

Here's Why 'Buffalo' Pumps' *Quality* Is Your Best Economy... Resulting In *Lower Overall Cost:*

- The complete 'Buffalo' Quality Line offers the right pump for almost every liquid-moving need. Thus you pay only for the type, size and capacity required . . . no more. This can save you money from the start.

- Maximum Parts Interchangeability through standardization of parts cuts inventory costs and stocks. This, plus simplified inventory control, provides additional economies.

- 'Buffalo' Stresses Quality through and through, to insure many years of productive pump life. This is true long range economy. Rugged construction provides extended trouble-free operation. Result? Less down-time adds further economies.

- Maximum Hydraulic Efficiency is engineered into every 'Buffalo' Pump. This means more liquid moved for each unit of power. Still more economies!

Any way you look at it, 'Buffalo' Quality Pumps insure greater economy for you. Your 'Buffalo' representative will be glad to help solve your liquid moving problems. Phone him today, or write us direct.

"Buffalo" PUMPS

BUFFALO PUMPS DIVISION
BUFFALO FORGE COMPANY
Buffalo, New York
Canada Pumps Ltd., Kitchener, Ontario

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

New FOAMGLAS® STAY-DRY

Five important benefits for all

Constant insulating value. North Brothers Contractors, Atlanta, Ga., found an excellent way to prevent insulation "fade" on building service piping at Colbert County Hospital, Sheffield, Ala. The low-cost solution was FOAMGLAS STAY-DRY Pipe Insulation. The closed glass cell composition of FOAMGLAS makes it completely impervious to water and atmospheric moisture—even in this highly humid climate. Thus, it never loses its insulation value, assures constant thermal efficiency for the life of the building.

Installed and finished in one operation. There is no priming of the pipes at the beginning of the job. Just apply the 24-inch sections of FOAMGLAS, seal the longitudinal flap of the jacket with PC's Pittseal 222 and apply a 3″ butt strip. Band at the butt joints and center of the segment. No separate vapor barrier or vapor seals are necessary since FOAMGLAS is its own vapor barrier. Sections are easy to cut and shape to accommodate any pipe run irregularities. One easy operation with one material from one supplier.

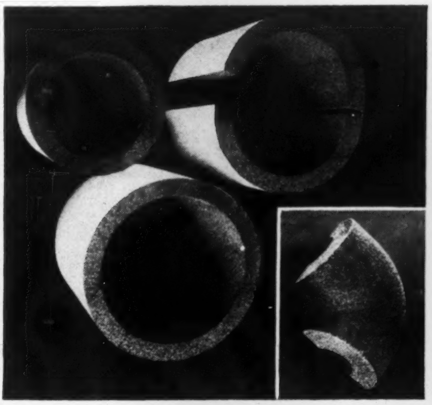
No weak spots . . . no slump or sag. Its high compressive strength lets FOAMGLAS support its own weight. There is no slumping or sagging of the insulation, regardless of how high the vertical piping runs may be. That same strength permits pipe hangers to support the insulation without danger of compression or puncture. This prevents thermal short circuits and eliminates the expense of wrapping hangers in felt. Since FOAMGLAS eliminates condensation, hangers will never rust out.

PITTSBURGH

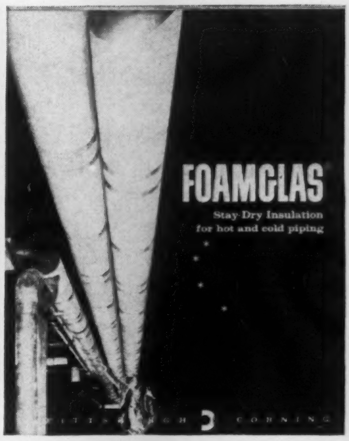
Pipe Insulation...

building service lines

No fire hazard. FOAMGLAS is inorganic so it cannot burn—even when subjected to the extreme test illustrated here. To insure this complete incombustibility, even the Kraft-laminate jacket is *self-extinguishing*, and no additional fire-proofing treatments are necessary. Many insulations act as a wick in cases of fire, but FOAMGLAS is the only completely fireproof insulation available to commercial builders today—and at no additional cost.



Complete range of sizes and fittings. Now complete piping systems can have all the benefits of FOAMGLAS STAY-DRY Pipe Insulation, for temperatures ranging from +35° to +350°F. Available in 1″ and 1½″ thicknesses for all lines from ½″ copper tubing to 12″ I.P.S. Sizes through 6″ I.P.S. are shipped in 24″ lengths; 8″, 10″, and 12″ I.P.S. in 18″ lengths. Fitting covers and elbows can be furnished for all fittings used in piping systems up to 12″ I.P.S. This full range of sizes makes FOAMGLAS suitable for ice water lines, chilled water lines, low pressure steam lines, hot water and dual temperature lines as well as larger underground piping. Standard FOAMGLAS is ideal for tanks and allied equipment in building service systems.



FOAMGLAS

Stay-Dry Insulation for hot and cold piping

PITTSBURGH CORNING

Write for new catalog. For detailed information, write for our new FOAMGLAS STAY-DRY Pipe Insulation Catalog, FI-108. Just address your request to: Pittsburgh Corning Corporation, Department HP-110, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Que.

PC CORNING

NO MORE COSTLY OVERHEATING PROBLEMS WITH NEW LESLIE-EVENTEMP* REGULATORS

This is more than a promise—it's a money-saving fact! This is the temperature regulator that corrects overheating problems—*before* they get to the heater. A compact pilot design insures dependable, even-tempered control for storage-type heating or cooling.

The Leslie-Eventemp is a single-seated, tight-closing temperature regulator. Its patented Leslie-Spiroflex* metal diaphragm provides long valve travel, long service life. This is the exclusively Leslie feature that makes the Eventemp a *no-nonsense* kind of regulator. Once on the line, it *stays* on the line.

With the Eventemp, you can virtually design regulator downtime out of your system. Its rugged, low-cost temperature-sensing element unscrews in just moments for a range change or replacement. No messy gas fills or vapor pressure elements! No factory returns! The simple internal pilot has sensibly sized ports, and there are no close-fitting parts to act up.

For capacity and application data on Leslie-Eventemp Regulators, write for Bulletin or contact your Leslie Engineer—he's listed in the Yellow Pages under 'Valves' or 'Regulators'.

LESLIE **Leslie Co., 703 Grant Avenue, Lyndhurst, New Jersey**

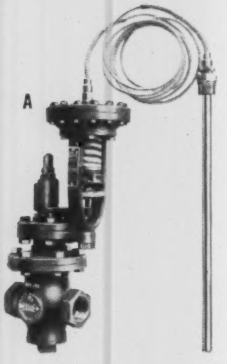
A Leslie-Duomatics* regulate both temperature and pressure in a single regulator. For storage or instantaneous heater services with inlet pressures from 20-600 psig.

B Direct-operated regulators for heating or cooling services in sizes ⅜ to 1". Handle pressure drops up to 100 psi.

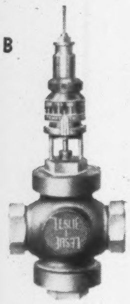
C Leslie air-operated temperature pilots operate control valves and air-loaded regulators in heating and cooling services.

*Trade Mark of Leslie Co.

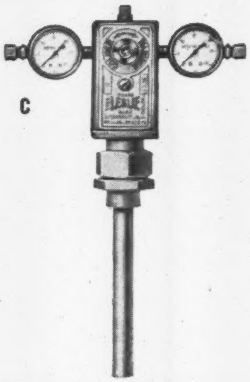
A

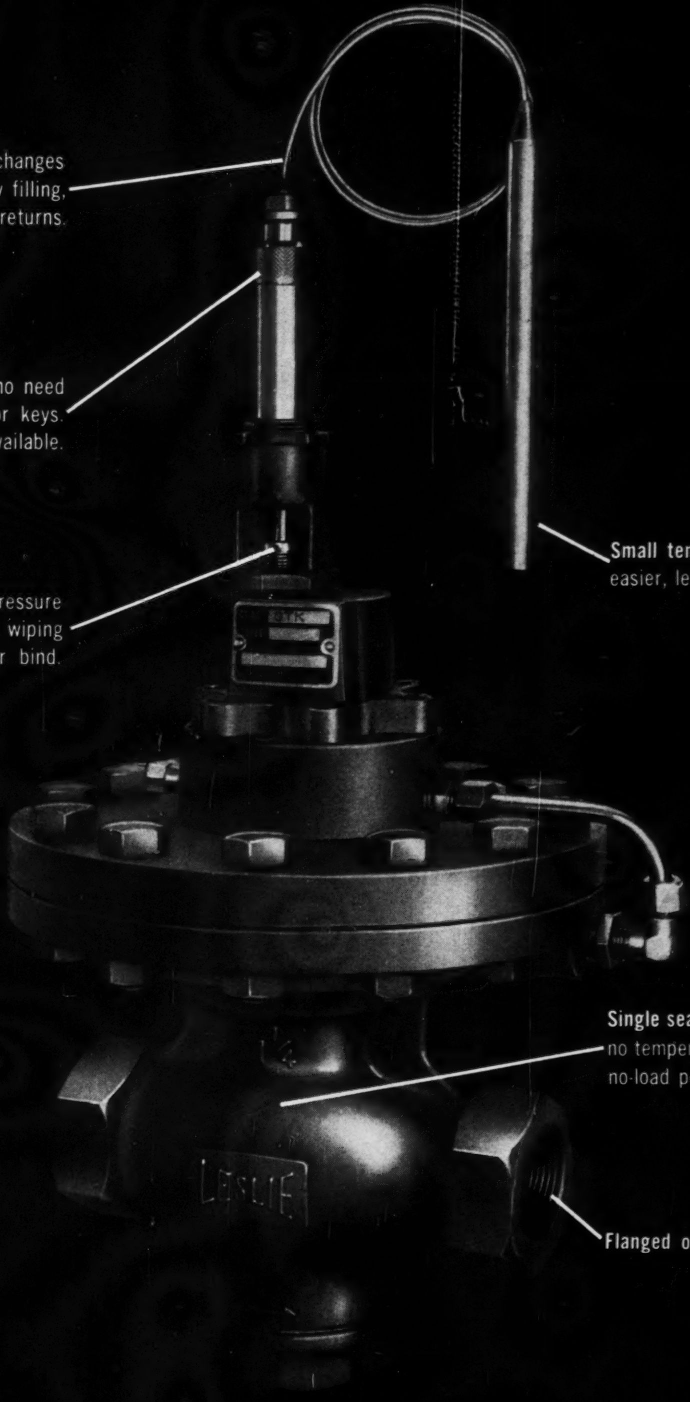


B



C





Renewable thermo-element — changes in moments. No messy filling, no costly factory returns.

Simple, knurled adjustment — no need for special tools or keys. Calibrated adjustment available.

Friction-free stem seal — pressure sealing with stem wiping action. Can't foul or bind.

Small temperature sensing bulb — easier, less costly to install.

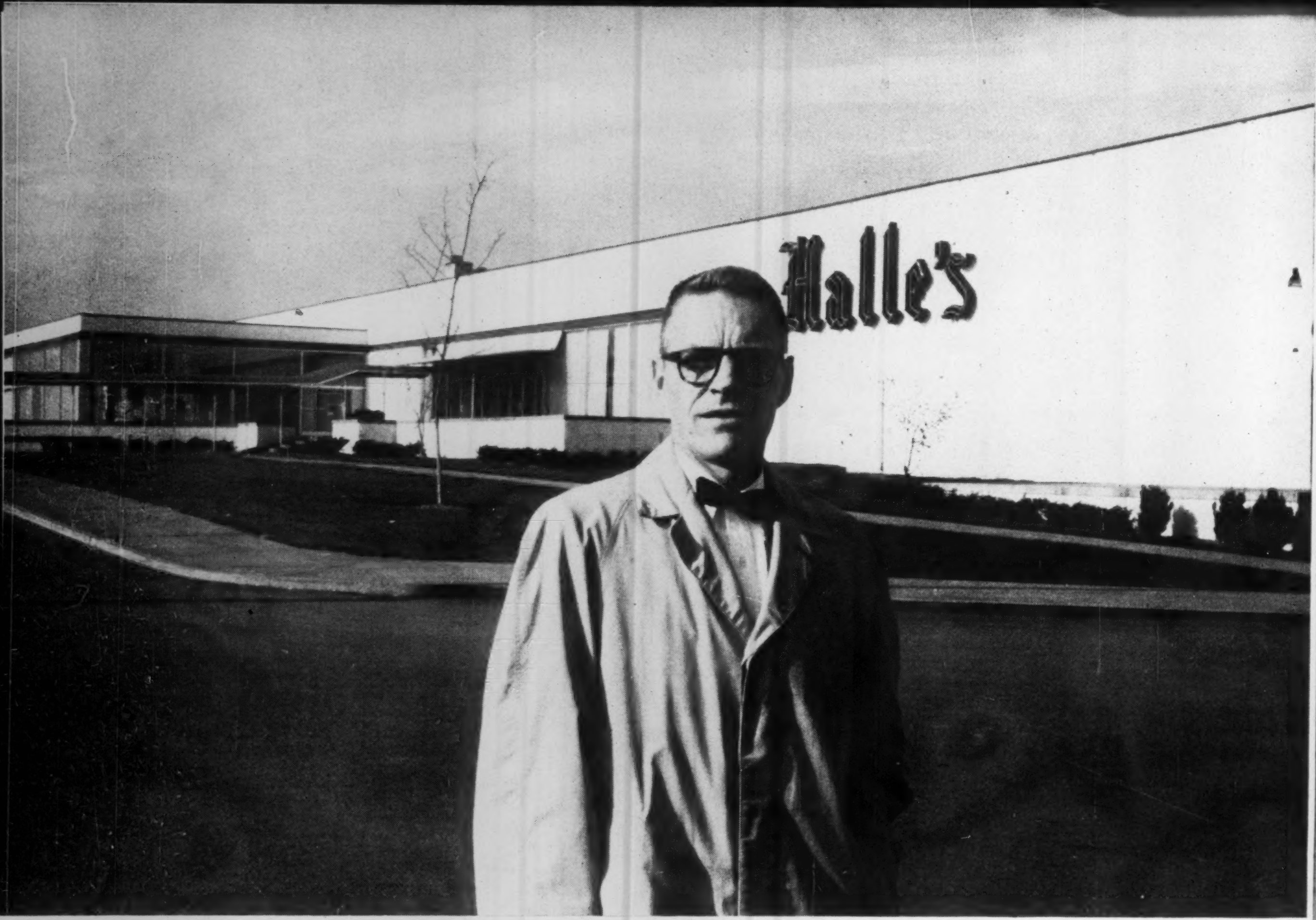
Single seated — tight closing . . . no temperature buildup on extended, no-load periods.

Flanged or screwed end connections.

LESLIE-EVENTEMP Regulators are single seated in all sizes, ¼″–4″. In bronze or iron, they handle inlet pressures up to 150 psig.

TRADE LESLIE MARK

REGULATORS and CONTROLLERS



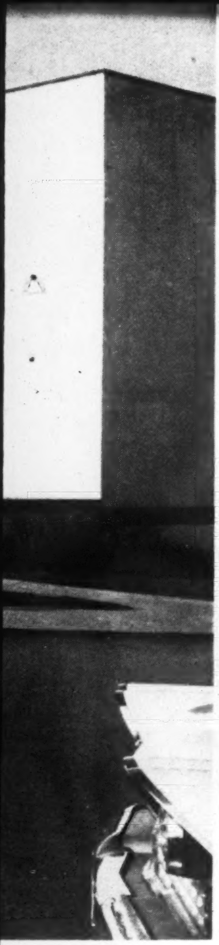
J. L. VanNort, Midwest Regional Sales Manager. Shoppers are cool and comfortable in Halle's modern store in suburban Cleveland, Ohio, which utilizes two 200 hp. Reliance Hermetic Refrigeration Motors that drive two-stage centrifugal compressors.

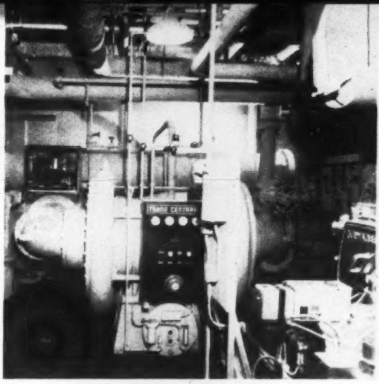
"Duty Master *has* what air conditioning customers expect in a motor... uninterrupted, trouble-free operation

"The new Duty Master A-c. Motor has all the inherent design characteristics that keep it operating when you need it most. There's a Duty Master built for *every phase* of an air conditioning system . . . from the giant Hermetic motors to rough, outdoor applications. Many of the reasons for Duty Master's adaptability to this field stem from its qualities of built-in protection. So you get the benefits of low maintenance and *uninterrupted service.*

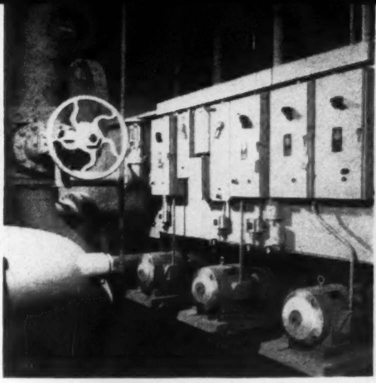
"Our Reliance engineers work constantly with equipment builders, consulting engineers, contractors and end users . . . to come up with sound applications of Duty Master Motors that completely match their needs."

RELIANCE - R - Duty Master A-C. MOTOR

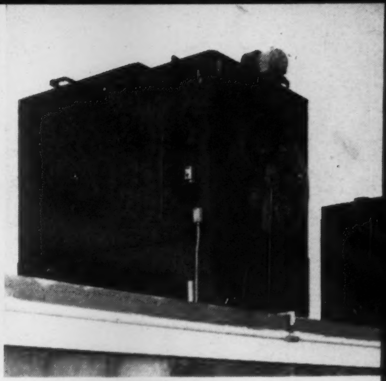




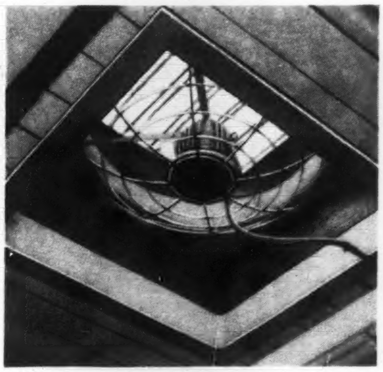
Centrifugal Compressors



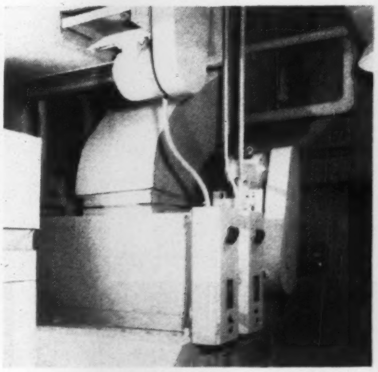
Chilled Water Pumps



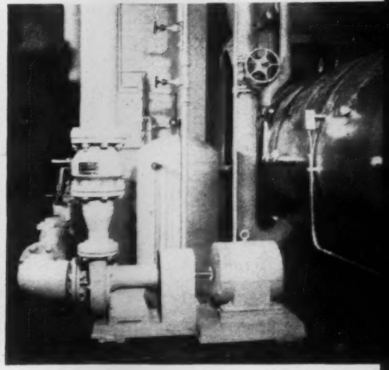
Cooling Towers



Exhaust Fans



Air Handling Equipment



Boiler Feed Water Pumps

Duty Master: electrical stamina—mechanical strength

The pictures of other installations tell the story of Duty Master's full-system service. Vitally important is the Hermetic Lecton*-insulated Refrigeration Motor, driving a centrifugal compressor. It repels freon, oil, water and heat . . . retains dielectric strength and resists flaking. Cuts maintenance and uncomfortable downtime. Accelerated 5-year tests show no insulation deterioration or breakdown, even when motor is operated continuously at 300°F! It's available from 10 to 1000 hp.

In other applications shown, the quiet Duty Master does a competent, uninterrupted job. It is not affected by dust, dirt or moisture. Multiple-dipped insulation, plus metered lubrication system (Metermatic) give you the built-in protection so necessary for efficient operation. Maintenance is at a minimum.

For special applications, such as gas absorption systems, the Reliance Submersible Motor can be safely immersed in water, oil, or liquid chemicals, in this case lithium bromide. Exclusive Reliance "Liqui-Seal" construction seals oil in, foreign contaminants out.

Reliance gives you a wide variety of modifications for any air conditioning application . . . pump-mount adaptors, vertical NEMA C-Face and D-Flange motors, P-Base motors . . . in all enclosures. Duty Master A-c. Motors are now available, ready to ship, in 1 through 250 hp. ratings.

Your nearest Reliance Sales Engineer or distributor can show you why the Duty Master line is so completely suited to your air conditioning requirements. Call him. If you choose, write for detailed information—Bulletins B-2507 and B-2505.

B-1649

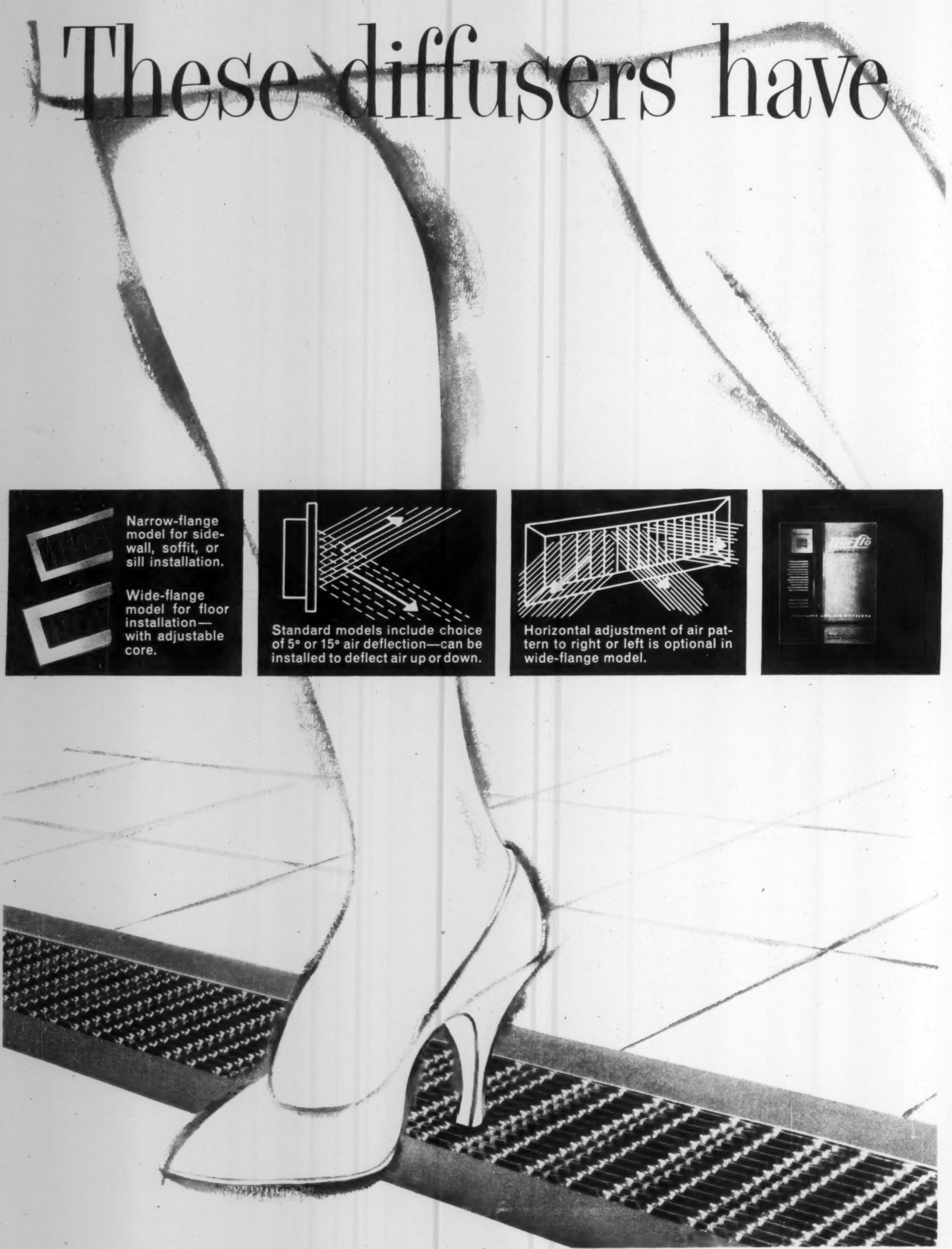
*DuPont Registered Trademark

**Product of the combined
resources of
Reliance Electric and
Engineering Company and its
Master and Reeves Divisions**

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 3611A, CLEVELAND 17, OHIO
Canadian Division: Toronto, Ontario
Sales Offices and Distributors in Principal Cities

Duty Master A-c. Motors, Master Gearmotors, Reeves Drives, V★S Drives, Super 'T' D-c. Motors, Generators, Controls and Engineered Drive Systems.



These diffusers have

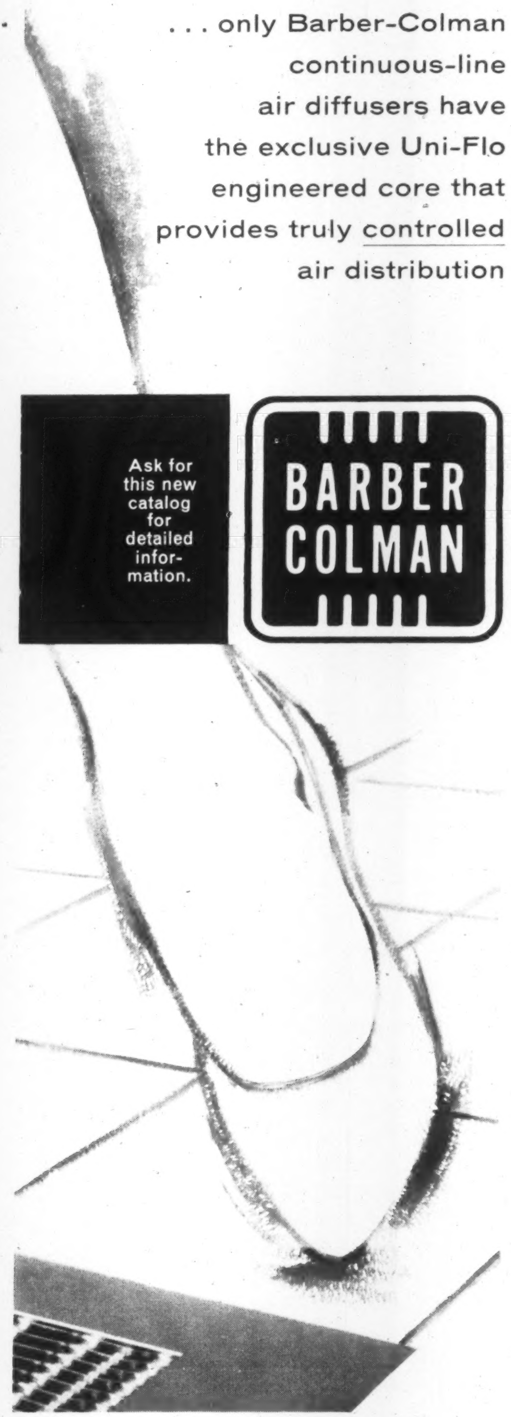
Narrow-flange model for side-wall, soffit, or sill installation.

Wide-flange model for floor installation—with adjustable core.

Standard models include choice of 5° or 15° air deflection—can be installed to deflect air up or down.

Horizontal adjustment of air pattern to right or left is optional in wide-flange model.

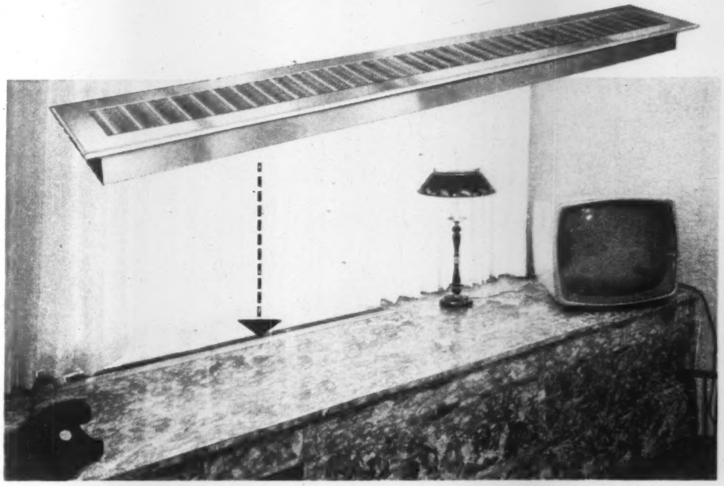
beauty plus "brains"



. . . only Barber-Colman continuous-line air diffusers have the exclusive Uni-Flo engineered core that provides truly controlled air distribution

Ask for this new catalog for detailed information.

BARBER COLMAN



A continuous-line diffuser has to do more than attractively cover the air duct opening in a sidewall, soffit, sill, or floor. Correct air diffusion involves control of aspiration, pattern, direction, and sound.

The exclusive core design of Barber-Colman Uni-Flo continuous-line diffusers assures rapid diffusion and high rate of aspiration. It eliminates the drafts and discomfort which can result from grilles which simply "pour" a stream of air into the room. Barber-Colman diffusers are guaranteed to perform in accordance with published laboratory performance data and to deliver results that meet human comfort requirements.

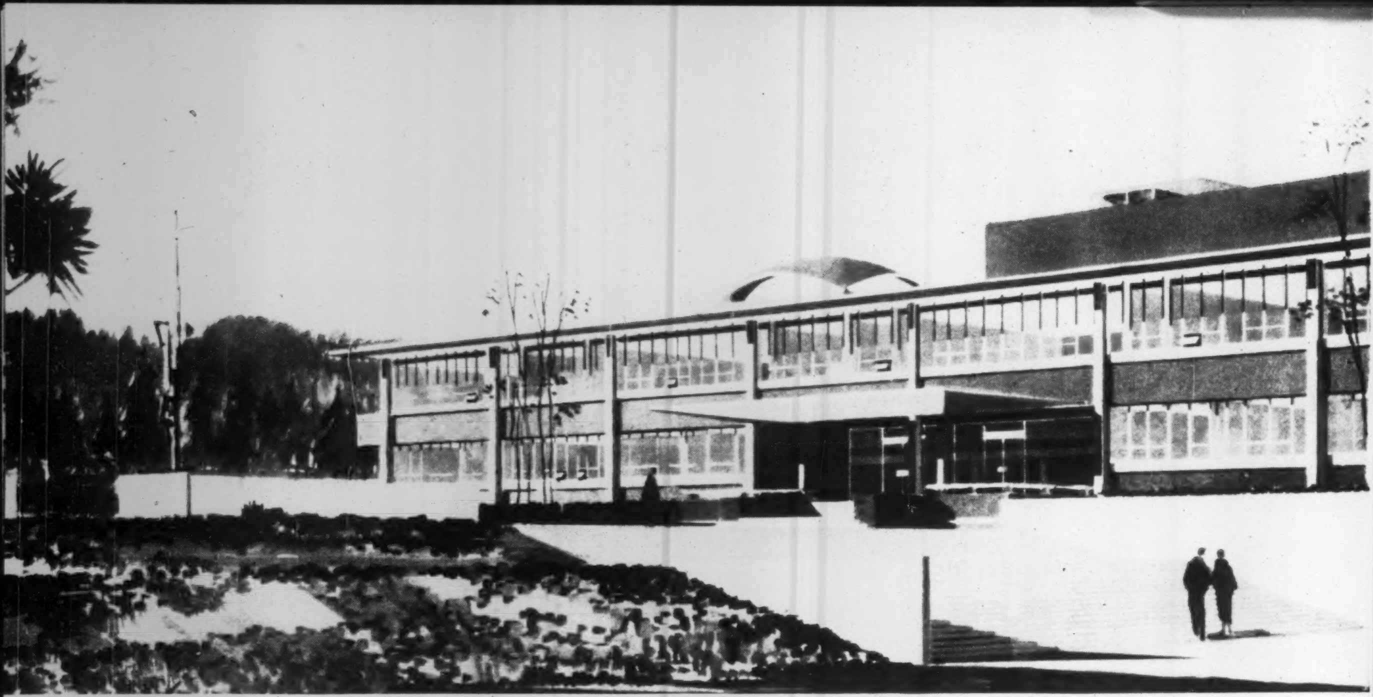
The diffusers are available with attractive narrow- or wide-flange aluminum frames in anodized or baked enamel finishes. Either aluminum or steel cores are available.

The Model ST narrow-flange model, especially suited to under-the-window installations, and Model STW wide-flange model for sill, sidewall, soffit, or floor installations are both available in 1½″ through 6″ heights in increments of ⅛″. Model STWA wide-flange diffusers with adjustable core are supplied in heights from 2″ to 12″ in increments of 1″.

Complete information and prices upon request. Consult your Barber-Colman Air Distribution field office or write direct.

BARBER-COLMAN COMPANY

Dept. K, 1101 Rock Street, Rockford, Illinois



New science building requires complex heating and ventilating system

BETHCON galvanized steel for air ducts preferred by sheet metal superintendent

This is the new science building at Western Washington College of Education, in Bellingham, Wash. The constant presence of noxious fumes makes ventilation of this building an important factor. Equally vital is the precise control of temperature. An extensive system of ductwork was designed and installed to perform these functions, involving the use of many tons of Bethcon galvanized steel sheets for air supply.

"Excellent Lock-Forming Qualities"

The mechanical contractors, Diamond "B" Plumbing and Heating Co., were quite emphatic in their preference for Bethcon sheets. "We favor Bethcon," says Ken G. Peterson, sheet metal superintendent of Diamond "B" "because of its excellent lock-forming qualities."

Taken for granted was the superiority of galvanized sheet steel over other materials sometimes used for ductwork. Steel's inherent strength permits the forming of light-weight, rigid ducts and other assemblies which require few supporting spans.

Ideal Blend of Stiffness and Ductility

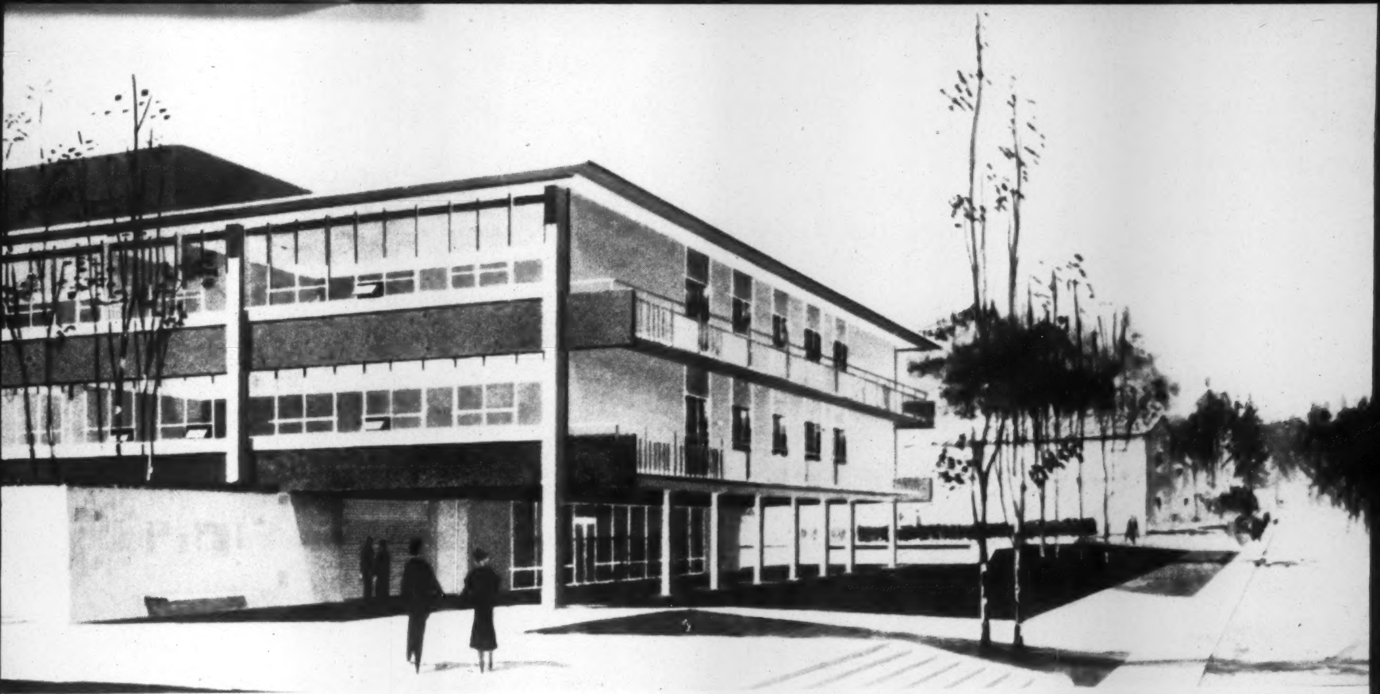
You'll find that Bethcon is the ideal galvanized sheet for sheet-metal work. It has just the right balance of stiffness and ductility for easy forming and sturdy finished product. The secret lies in Bethlehem's continuous galvanizing process which includes a special annealing cycle. This galvanizing process also bonds the zinc so tightly to the steel that peeling and cracking are virtually eliminated.

You can specify Bethcon coiled or in sheets, in a wide variety of gages, in either plain open-hearth or copper-bearing steel. For specific details, simply call or write to the Bethlehem office nearest you, or write to the address below.

Galvanized Steel

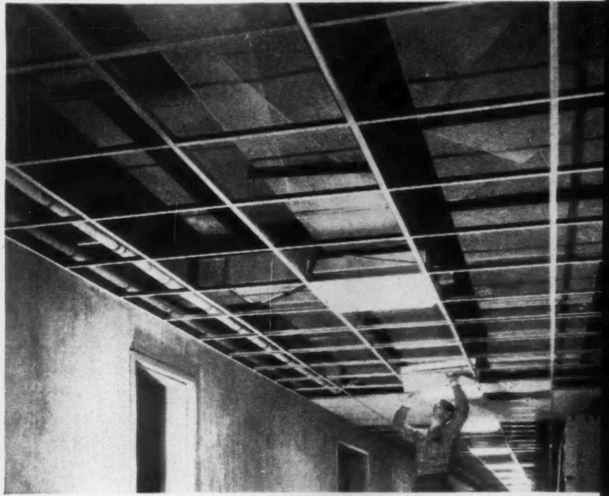
for Strength
... Economy
... Versatility

BETHLEHEM STEEL



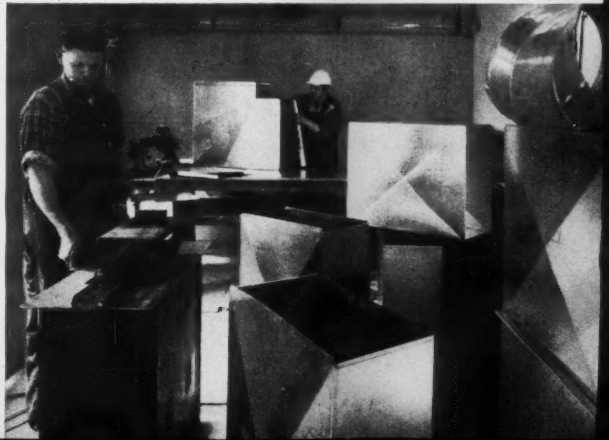
New science building for Western Washington College of Education, Bellingham, Wash., completed in July 1960. *Architect:* Paul Thiry, F.A.I.A., Seattle; *Mechanical Engineer:* James B. Notkin, & Associates, Seattle; *General Contractor:* Hebb and Narodick Construction Co., Seattle; *Mechanical Contractor:* Diamond "B" Plumbing and Heating Co., Bellingham.

This maze of ducts was needed to handle the exacting temperature and humidity requirements, as well as the removal of a wide variety of fumes from classrooms and labs.



Only the strength and rigidity of galvanized steel sheets will permit su long spans of ductwork with so little need for support.

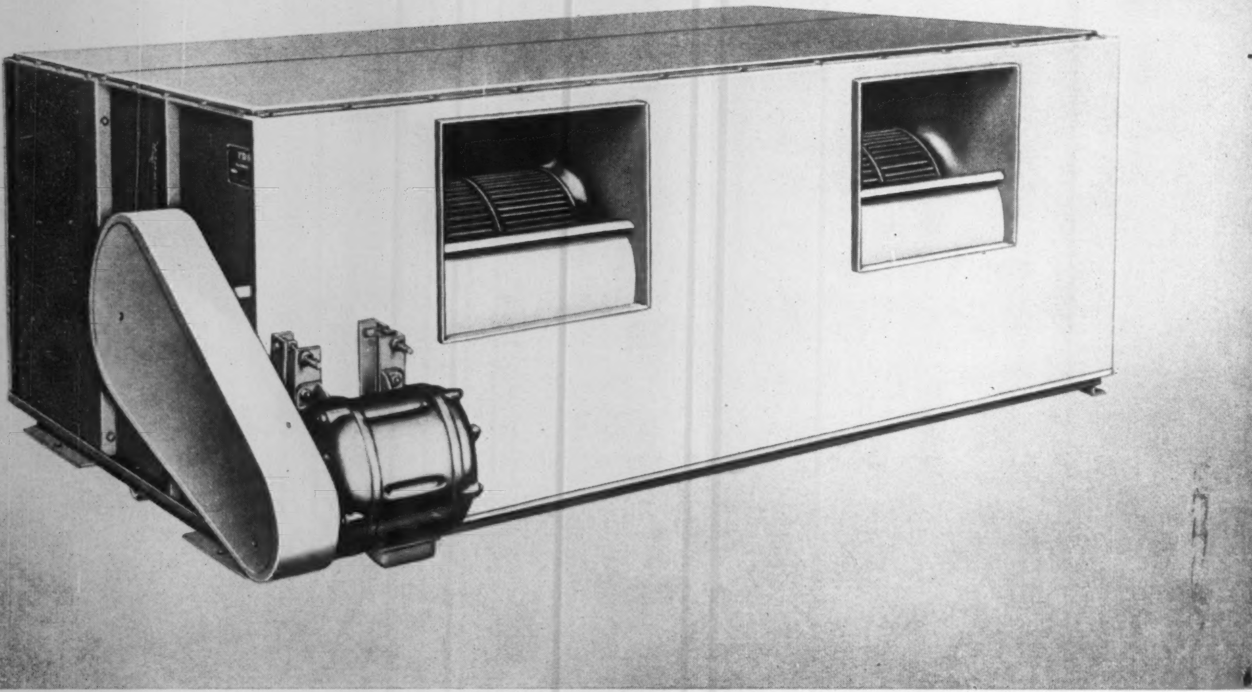
Superior lock-forming qualities led the mechanical contractors to insist on Bethcon galvanized sheets for the complex ventilating, heating and air-conditioning system.



BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

You'll solve more with Trane Central



Here's why TRANE Climate Changers solve more difficult application, installation and maintenance problems:

- **Compactness.** Substantially reduced dimensions solve problems of limited installation space while maintaining top performance.
- **More sizes.** For efficient application flexibility, there are 14 sizes in the Standard (draw-through) type, and 13 sizes in the Multi-Zone double duct (blow-through) type. Each type covers the range of 6 to 63 sq. ft. coil face area.
- **Reliable ratings.** TRANE Climate Changers are fully tested and accurately rated as complete assemblies.
- **Exclusive one-inch O.D. tube non-freeze steam coil.** Provides uniform leaving air temperature over full face area of coil down to 6 per cent of full loading.
- **Exclusive Multi-Zone damper design** provides positive all-round seal for both hot and cold decks to eliminate leakage.
- **Life-lubricated ball bearings** prevent start-up damage due to improper on-the-job lubrication procedures. Eliminates time-consuming lubrication maintenance.
- **Improved mixing box** and damper design assures complete mixing of outside and return air, eliminates stratification.
- **Complete fan assembly electronically balanced** in unit before shipment, assures unit will operate without vibration.

Advanced engineering features assure high performance of Trane Coils!

The TRANE Sigma-Flo Fin design increases heat transfer efficiency. Casing design reduces over-all dimensions, eliminates air by-passing the coil, minimizes moisture carry-over on dehumidifying coil. Heating coils feature a non-freeze design with one-inch O.D. tubes as standard. The cooling coil line features an all-purpose coil, a completely drainable coil, a completely cleanable coil and a direct expansion coil. Sigma-Flo Fins have S-shaped contours to assure uniform air turbulence over the *total* fin. The result is high heat transfer efficiency. Tubes are mechanically expanded into wide fin collars to provide a permanent solderless bond.

These advanced engineering features are yours in *standard* TRANE Coils—priced competitively with conventional coils! Ask your nearby TRANE Sales Office for complete facts on these coils—and about the cooling coil selection method (exclusive with TRANE) that saves time, assures unparalleled pinpoint accuracy!

air handling problems Station Climate Changers!

Superior versatility. Unmatched flexibility. Wider range of sizes. And, an advanced coil design, exclusive with Trane!

Here is the latest advance in central station air conditioners: TRANE Climate Changers, with exclusive engineering features, quality built throughout. These units are highly compact, have unequaled versatility; and there are over 100 standard units to enable you to meet the exact requirements of any job more accurately.

You can select TRANE Climate Changer units, step-by-step, to meet the most exacting job specifications. The result is a system of perfectly matched components to meet your specific air conditioning requirements. There are draw-through and Multi-Zone models—available in both medium and low-pressure types, in a widened range of capacities from 1,200 to 47,000 cfm.

Ratings for consistent and accurate performance of TRANE Climate Changers have been established after nearly 30,000 man hours of engineering, research and testing.

The Climate Changer fan assembly is electronically balanced before shipment to provide greater protection against vibration.

Next time you're planning a job calling for a central station unit, ask your nearby TRANE Sales Office for complete facts on the Climate Changer line. Or, if you prefer, write directly to TRANE, La Crosse, Wisconsin.

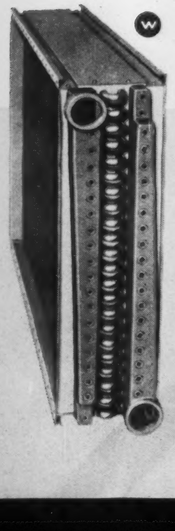
For any air condition, turn to

TRANE

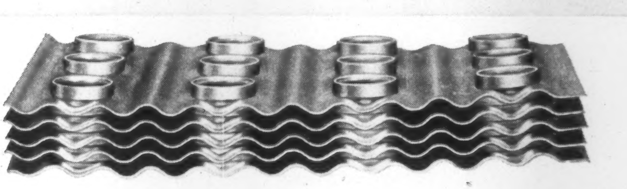
MANUFACTURING ENGINEERS OF AIR CONDITIONING,
HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 100 U. S. AND 19 CANADIAN OFFICES

Type N steam coil, non-freeze design, with one-inch O.D. tubes that provide uniform temperature distribution across coil face. Positive protection against freeze-up.



Type W all-purpose water cooling coil, from return end. Rugged cast-iron headers with hydrodynamic design provide most efficient flow distribution, assure uniform distribution to all tubes and minimum pressure drop.



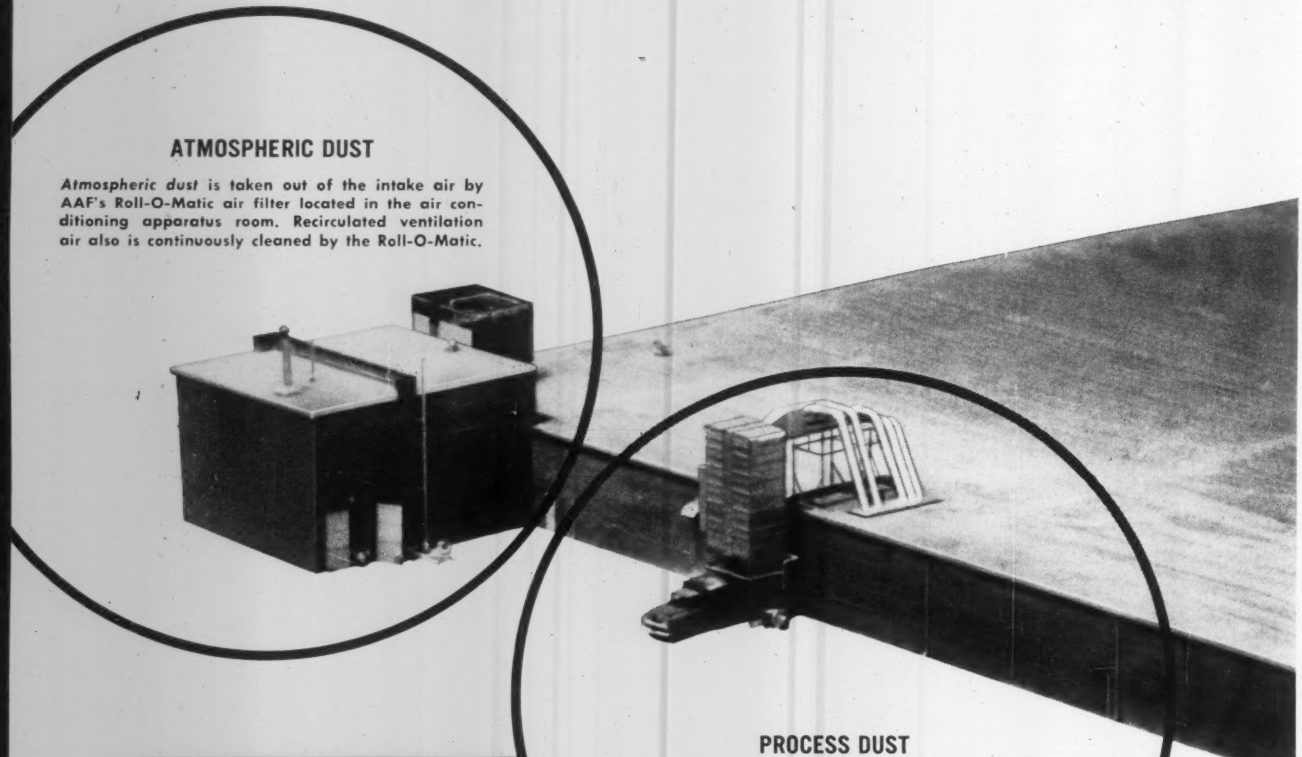
New Sigma-Flo Fin features wavy design that improves heat transfer efficiency, results in more compact design. Fins, die-formed in multiple stages, provide accurate tube fits and fin bonding spacing.

AAF clean-air engineering makes

...despite

ATMOSPHERIC DUST

Atmospheric dust is taken out of the intake air by AAF's Roll-O-Matic air filter located in the air conditioning apparatus room. Recirculated ventilation air also is continuously cleaned by the Roll-O-Matic.



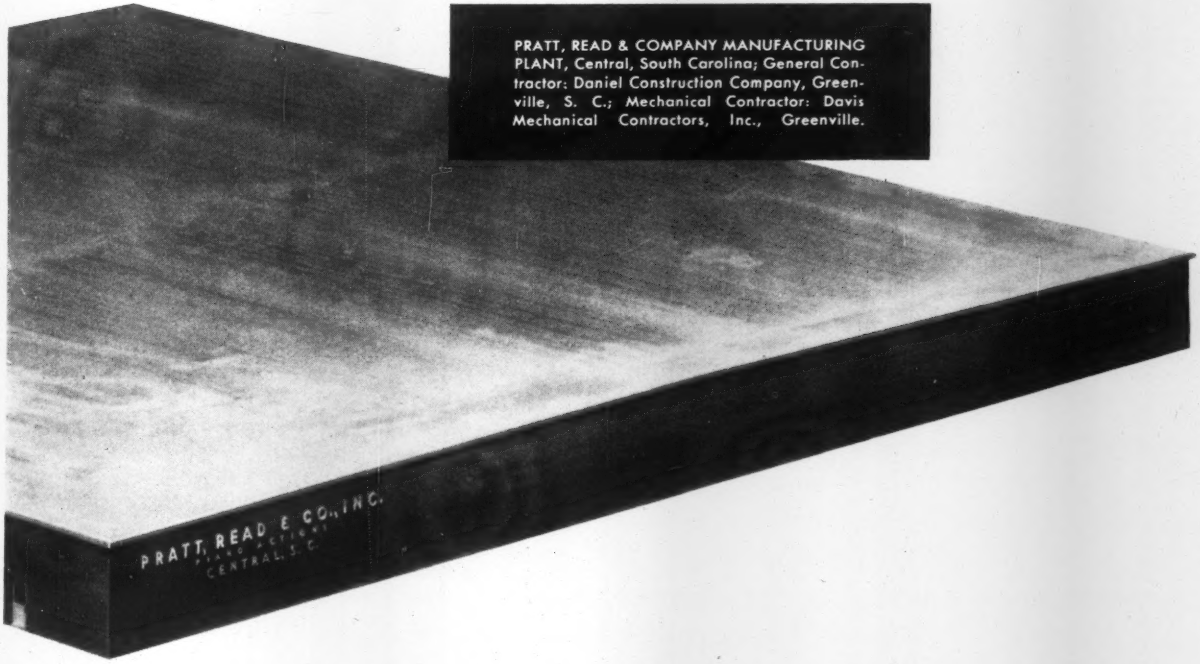
PROCESS DUST

Process dust from 150 dust sources is collected by AAF's AMERjet reverse jet fabric collector. It settles the dust in its hoppers, returns clean air back through the central system.

Interior of plant showing multitude of dust-producing operations.

air conditioning practical here...

150 dust-producing operations going full blast!



PRATT, READ & COMPANY MANUFACTURING PLANT, Central, South Carolina; General Contractor: Daniel Construction Company, Greenville, S. C.; Mechanical Contractor: Davis Mechanical Contractors, Inc., Greenville.

AAF system permits air recirculation, slashes heating-cooling, maintenance costs

Pratt, Read & Company, manufacturers of piano keys and actions, wanted its new Central, South Carolina plant to be air conditioned. Reasons: better working environment for its people and improved quality of its products. Problem: the fact that 150 dust-producing operations would be going at full throttle during the working day.

AAF's air engineering knowhow, plus its complete line of air-cleaning products (for both atmospheric and process dust) made air conditioning practical by providing for money-saving recirculation of air. The savings: plenty—lower heating costs in winter, vastly lower cooling costs in summer, and a big savings in plant cleaning costs.

For a look at what we mean by a really *complete* line of equipment, call your local AAF representative or write direct for Bulletin 518. Address: Mr. Robert Moore, American Air Filter Company, Inc., 373 Central Ave., Louisville, Ky.

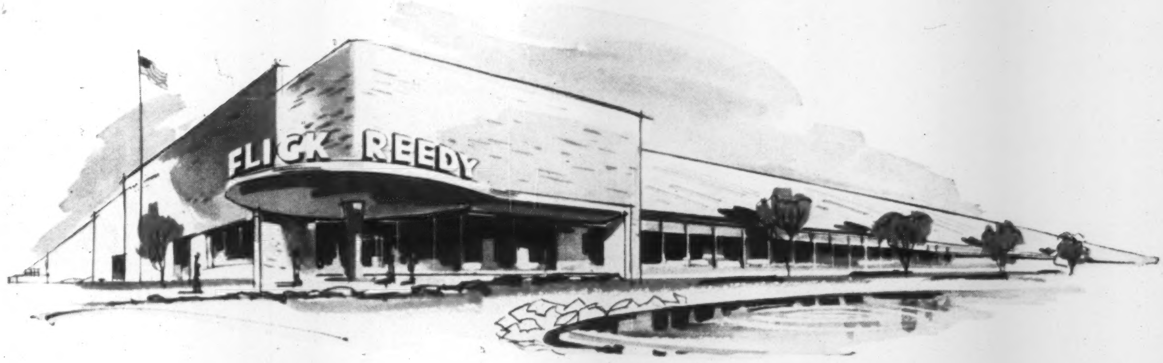
AAF American Air Filter
BETTER AIR IS OUR BUSINESS

Mr. Frank Flick, President, Flick-Reedy, Bensenville, Ill., says:

"Even this huge heat pump went smoothly with

Mr. Frank Flick, President, Flick-Reedy, and Mr. Zay Smith of Zay Smith and Associates; Architects and Engineers, LaGrange, Illinois.

control installation
Honeywell men on the job!"



Wall-mounted thermostats in every private office enable employees to dial the exact temperature they prefer. And in each of the buildings' working spaces, strategically placed thermostats assure comfort no matter what the activity.

Honeywell Engineers working on the air conditioning system at the distinctive new Flick-Reedy power cylinder plant, installed the exact control system needed for one of the world's largest heat pumps!

"The job of harnessing this huge heat pump was mighty important to us," says Mr. Flick. "Our plans called for a customized temperature control system which would assure the welfare of our employees, and solve certain critical production problems. It was a large order, but Honeywell Engineers, working with the York people and Zay Smith and Associates Engineers, solved the problem to our complete satisfaction."

Air conditioning this 220,000 square foot plant presented some unusual problems. The entire work area is fully air conditioned—including the welding, heat treat and plating areas. And, the entire system is completely automatic. A Honeywell Supervisory DataCenter* (shown in background) monitors the heat pump and controls temperatures in every zone.

In addition, every private office and conference room is equipped with its own Honeywell Round thermostat.

As the leader in temperature control for 75 years, Honeywell is well equipped to help you solve your clients' most critical temperature control problems. Call your nearest Honeywell office today. Or, write Minneapolis-Honeywell, Minneapolis 8, Minn.

**Trademark*

Honeywell

H HONEYWELL First in Control

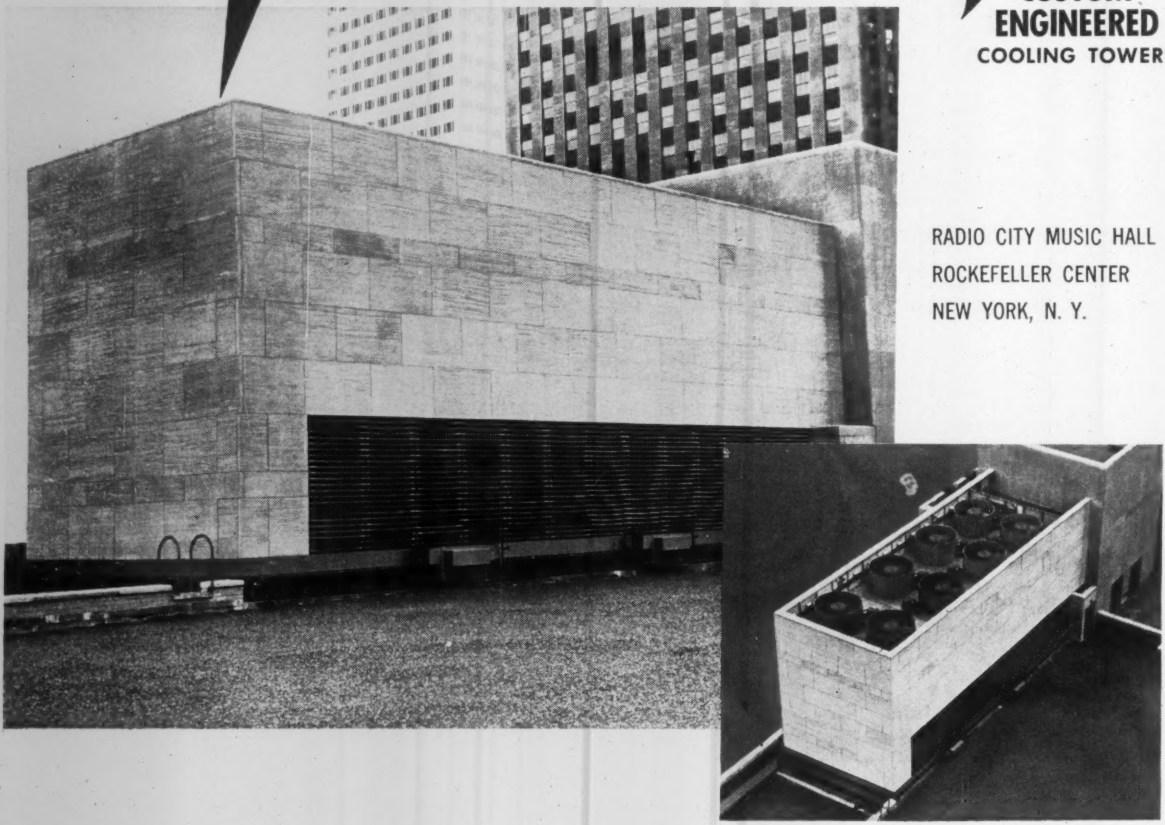
SINCE 1885

75th YEAR PIONEERING THE FUTURE

Here's how Phillips solves

another problem solved by Phillips

CUSTOM ENGINEERED
COOLING TOWERS



RADIO CITY MUSIC HALL
ROCKEFELLER CENTER
NEW YORK, N. Y.

The problem:

Combining beauty and efficiency in a limited space at low cost.

The solution:

PHILLIPS CUSTOM ENGINEERED COOLING TOWER with limestone casing to blend perfectly with surroundings. Space utilized so that additional tower may be erected as need arises. This tower gives maximum cooling surface per foot of space, and minimum maintenance cost.

cooling tower problems CUSTOM ENGINEERING

Whatever the problem — noise . . . freezing . . . space . . . maintenance . . . atmospheric conditions — you'll find PHILLIPS CUSTOM ENGINEERED COOLING TOWERS solve the problem better . . . at less cost. Why? Because here are the only cooling towers that are custom engineered to suit the conditions of each application. No wonder each year, more and more specifications call for PHILLIPS CUSTOM ENGINEERED COOLING TOWERS.

EVERY STEP CUSTOM ENGINEERED

CASINGS
Selection of material to fit Architectural treatment and surrounding conditions.

BASINS
Redwood, stainless steel, galvanized steel, carbon steel up to and including ¼" thickness with any desired coating, reinforced concrete basins supported on steel beams.

FILL
Redwood or pressure treated Douglas Fir. Slip-fit, self-supporting for easy removal for interior maintenance.

FANS
Multi-blade, adjustable propeller type fan in cast aluminum, stainless steel or Monel. Either direct driven fan in small sizes or indirect right angle worm gear drives.

DISTRIBUTION SYSTEM
Spray nozzle type or open Weir gravatational type system.

FRAMEWORK
Hot dipped galvanized structural steel .250" minimum thickness. Redwood or pressure treated Douglas Fir.

Write for literature

SPECIAL FEATURES ON ALL TOWERS

Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.

SWEAT-PROOF
INSULATION

Stop pipe condensation with the built-in vapor barrier of J-M Aerotube

...THE FLEXIBLE, FOAMED PLASTIC PIPE INSULATION THAT CUTS INSTALLATION COSTS IN HALF.

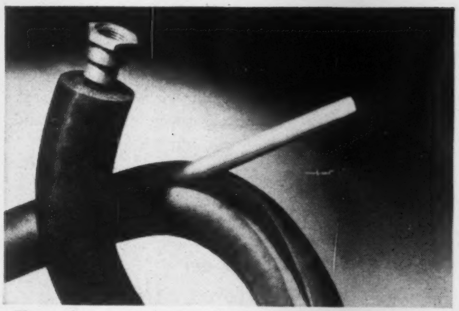
For heating, plumbing and air-conditioning service—wherever sweating or condensation is a problem—Johns-Manville Aerotube® is the economical solution.

Aerotube is a tubular pipe insulation for use at temperatures from 32F to 220F (double layer of Aerotube permits range of 0F to 220F). Its closed cell structure stops the passage of moisture. This built-in vapor barrier, plus the insulating effectiveness of Aerotube, will prevent condensation under normal design conditions on indoor lines. What's more, you

can depend upon Aerotube to maintain its effectiveness indefinitely.

Aerotube is the easiest-to-install pipe insulation available today. On a straight run of pipe or the most complex bend, Aerotube's six-foot lengths go on quickly. For connected pipe, just slit Aerotube longitudinally, snap it on, and seal it up! You'll discover that labor costs are substantially reduced when Aerotube is chosen to solve condensation problems.

Available in a wide range of thicknesses, there's an Aerotube insulation that meets your particular needs. For full information, send for brochure IN-213A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

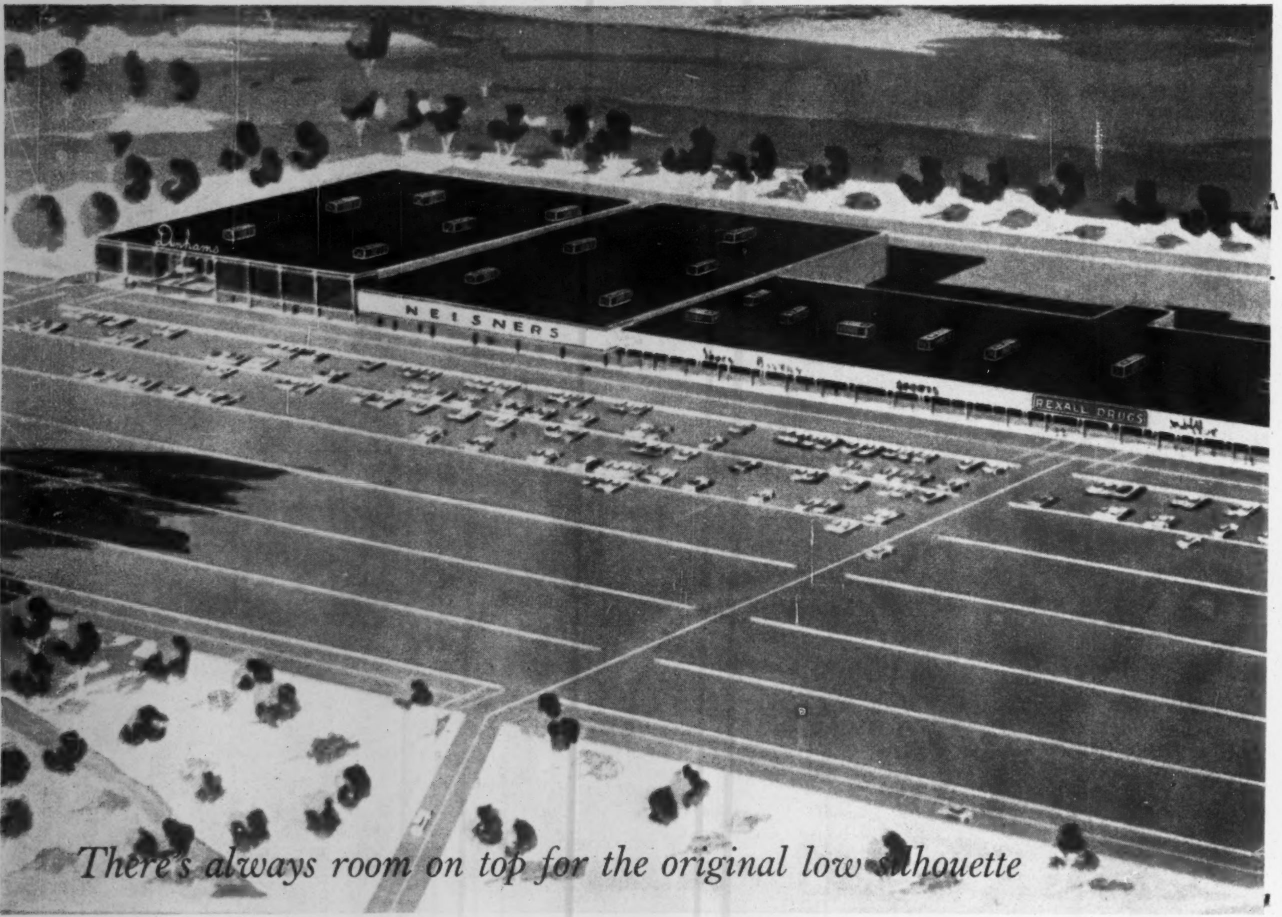


Even the most complex bend is easy to insulate with flexible J-M Aerotube.

JOHNS-MANVILLE

JOHNS MANVILLE JM PRODUCTS

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE



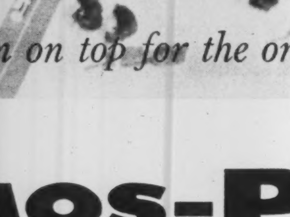
There's always room on top for the original low silhouette

THE ATMOS-PAK

- *designed for low cost year-round air conditioning*
- *roof-mounted for more interior design freedom*
- *pre-fabricated for quick installation*

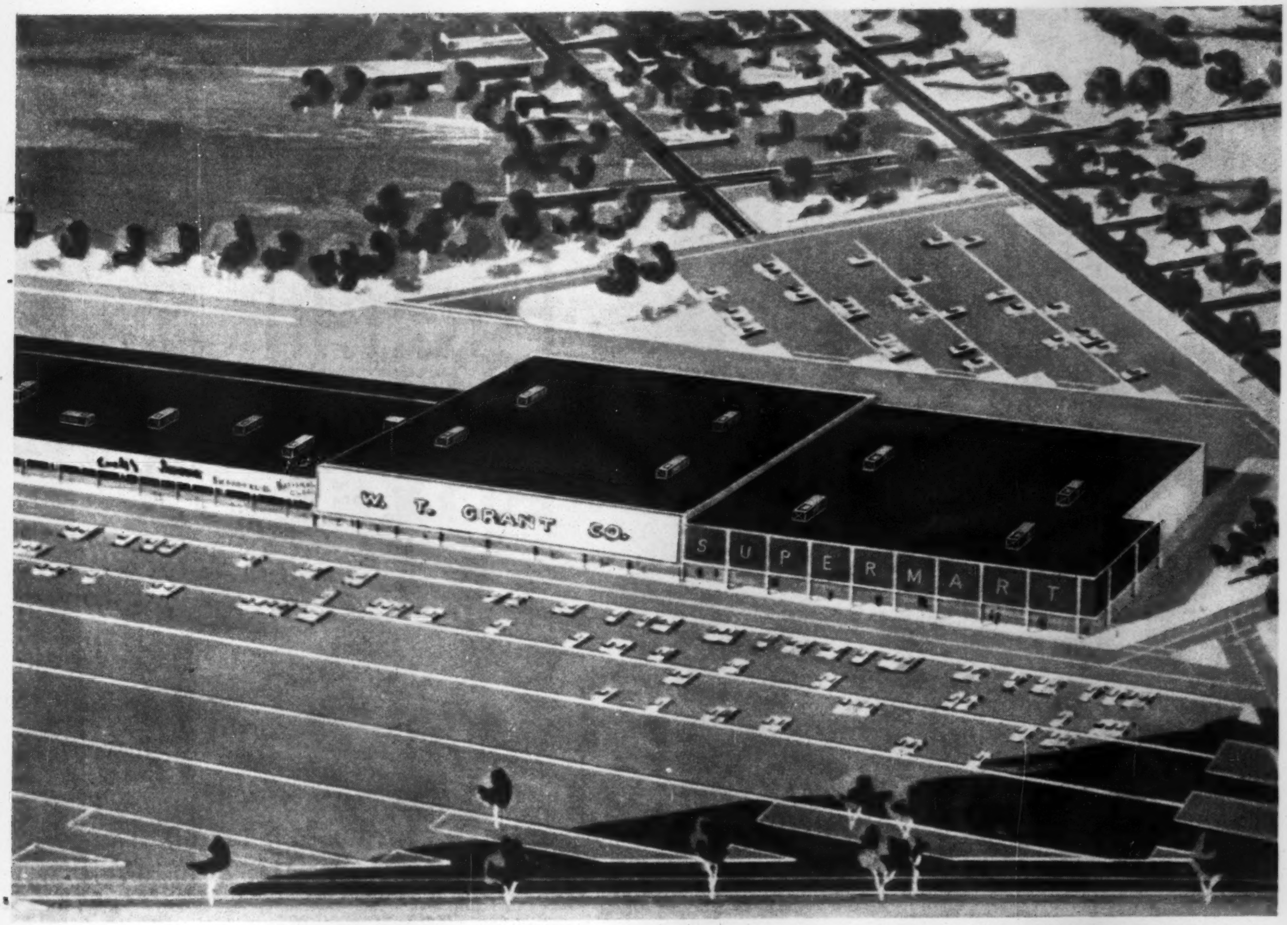
We list our exclusive features as proof that for any application involving one story structures — whether shopping centers, industrial plants, supermarkets, churches and synagogues, bowling alleys or post offices — our unit is the finest.

Year-round Unit
15 & 20 ton units constructed in one section
30 & 35 ton units constructed in two sections



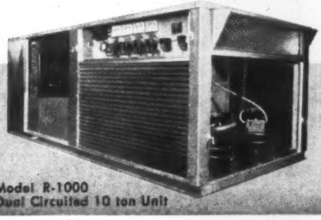
5, 7½ & 10 ton
Single Circuited Unit

10, 15 & 20 ton Year-round Unit
Constructed in one section

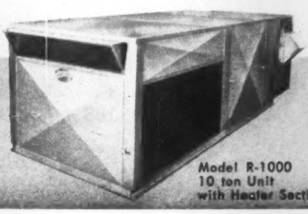


Trenton Lane Shopping Center, Trenton, New Jersey
General Contractor — J. C. Breyfogle
Architects — Milosevich and Trautwein
Developers & Managing Agents — Garfield Associates

FEATURES	THE ATMOS-PAK	UNIT A	UNIT B	UNIT C	UNIT D	UNIT E
Mechanical Chimney	Yes	No	No	No	No	No
Individually Fused Motor Circuit	Yes	No	Yes	No	No	No
All Blowers of the Centrifugal Type	Yes	No	Yes	No	No	Yes
All Components Completely Protected from the Elements	Yes	No	No	No	No	Yes
Preformed Continuous Refrigerant Piping Circuits	Yes	No	No	No	No	No
Supply and Return Air Distribution Chamber with Controlled Air Pattern	Yes	No	No	No	No	No
Permanent Lubrication	Yes	No	No	No	No	No
No Field Assembly Required	Yes	Yes	Yes	No	No	No
Internal Service Switch	Yes	No	Yes	No	No	No
Automatic Condenser Air Discharge Hood	Yes	No	No	No	No	No
Distribution Chamber Adaptable to Duct Work	Yes	No	Yes	No	No	No
Universal Heater Section	Yes	No	No	No	No	No
Complete Line of Units 5 through 35 tons	Yes	No	No	No	No	No



Model R-1000
Dual Circuited 10 ton Unit



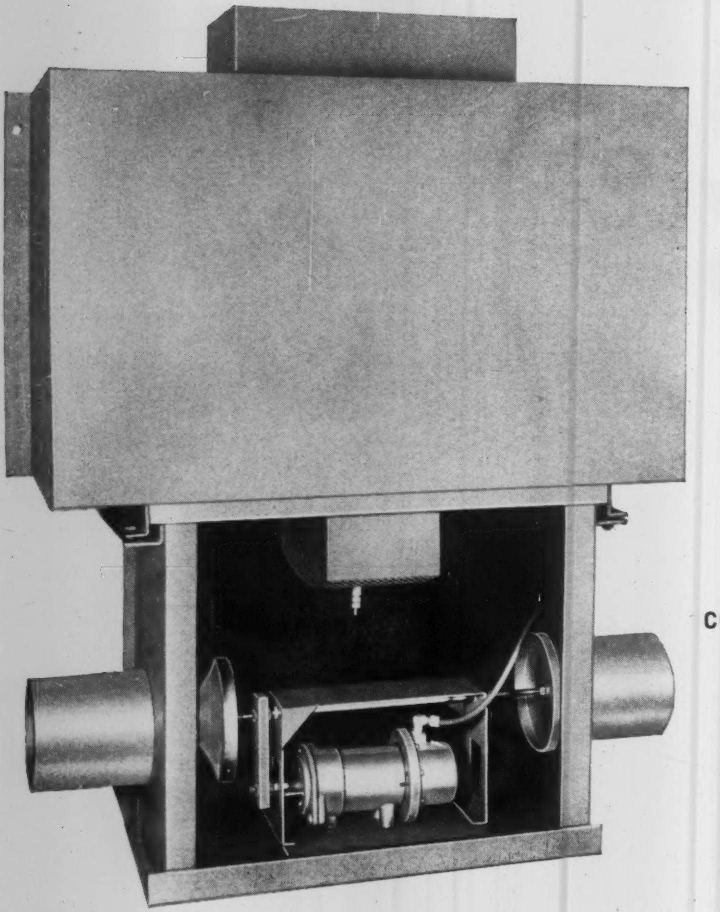
Model R-1000
10 ton Unit
with Heater Section

designed, manufactured, installed and PIONEERED by
AIR CONDITIONING, INCORPORATED
88 North Highland Avenue
Ossining, New York

® patented

the atmos-pak

ALL NEW AGITAIR® MIXING BOXES



A MAJOR DEVELOPMENT IN CONSTANT CONTROL AND DISTRIBUTION OF HIGH VELOCITY TEMPERED AIR

A simple design of the all new AGITAIR Type "O" series, high velocity mixing boxes eliminates all troublesome linkages and pivots. Only one motor is employed to operate the inlet valves which are driven directly, guaranteeing instantaneous response with no lost motion or backlash.

The mixing valves proportion the hot and cold air in response to the room thermostat and the unique AGITROL volume regulator guarantees constant control of air delivery at the required volume.

Comprehensive noise attenuation tests were conducted to assure extremely low sound ratings for ceiling and under the window units. And for noiseless, draftless distribution of the conditioned air from these units, there is a complete line of AGITAIR diffusers and grilles from which to choose.

Technical catalog HV-100 contains complete performance data and dimensions on all AGITAIR units. Write for your copy today.

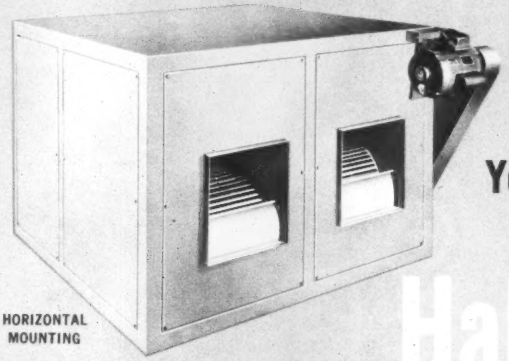
FEATURES

1. One motor — no linkages.
2. Aluminum inlet valves driven directly — instantaneous response . . . no lost motion . . . no backlash.
3. Unique AGITROL valve (constant volume regulator) actuated solely by the supply air.
4. Both mixing and attenuation chambers fabricated of galvanized or galvannealed steel . . . sealed to prevent air leakage.
5. Split fabrication of attenuation chamber permits dimension adaptation to meet most space limitations.

AIR DEVICES INC.
185 MADISON AVENUE • NEW YORK 16, N. Y.

BETTER PRODUCTS FOR
AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

CLIP THIS FOR YOUR FILES

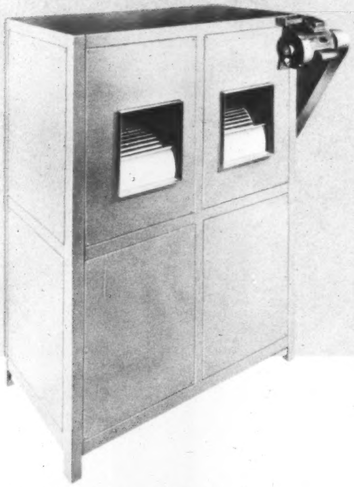


HORIZONTAL MOUNTING

You get more versatility in these new

Halstead & Mitchell central system air conditioners

that are built to last!



VERTICAL MOUNTING

YOU CAN COOL AND DEHUMIDIFY, HEAT AND HUMIDIFY, FILTER AND CIRCULATE AIR FROM THESE COMPACT H&M CENTRAL SYSTEM AIR CONDITIONERS.

AVAILABLE IN 3 TO 92 NOMINAL TONS AND WITH MATCHING HEATING COILS.

LOOK AT THE CHOICES YOU GET:

1. **H&M Turbu-Flo coils** with right or left-hand connections.
   Direct Expansion Cooling Coils *Chilled Water Cooling Coils*
   Non-Freeze Steam Heating Coils *Hot Water Heating Coils*
   Standard Steam Heating Coils
2. **Capacities of 3 to 92 nominal tons** with 880 to 47,750 CFM.
3. **Cooling coils of 1 to 8 rows; heating coils of 1 or 2 rows.**
4. **3 choices of coil face areas** for each model.
5. **Fin spacings of 6, 7, 8 or 10 fins per inch.**
6. **Horizontal or vertical mounting**; discharge in any direction.
7. **Variable Pitch drives on most units** for close adjustment of air quantities.
8. **Face and bypass dampers** to provide desired leaving air conditions.
9. **Mixing boxes** (with or without dampers) to control proportioning of ventilation and return air.
10. **High or low velocity filter sections** use throw away or cleanable type filters.
11. **Spray or steam grid humidifiers** for proper addition of moisture.

HERE'S WHY THESE H&M UNITS WILL ALWAYS GIVE TOP PERFORMANCE:

1. **Formed corner posts** of heavy gauge steel provide a rugged frame.
2. **Flush-mounted panels** look better, are easily removable for quick servicing.
3. **Fully insulated cabinets** assure quiet operation; are attractively finished.
4. **Permanently sealed ball bearings** on fans require no lubrication or servicing.
5. **Double width, double inlet centrifugal fans** handle large air quantities against static pressures up to 2 inches water column. Fans are statically and dynamically balanced for quiet running.
6. **Heavy duty fan motors** are standard NEMA frame sizes and are positively mounted on adjustable bases.
7. **Sound-dampening vibration isolators** are available for all units.
8. **Halstead & Mitchell Turbu-Flo coils** have an exclusive streamline fin pattern for better heat transfer.

HM

Halstead & Mitchell

Central System Air Conditioners • Cooling Towers
Air-Cooled Condensers • Water-Cooled Condensers • Finned Coils

CONDENSED DATA ON

H&M CENTRAL SYSTEM AIR CONDITIONERS

MODEL NO.	NOMINAL TONS*	BASIC CFM (at 500 FPM)	CFM RANGE† (400 TO 700 FPM) LOW TO HIGH	NO. OF BLOWERS	FACE AREA, Sq. Ft. STD.	MED.	LARGE
11 AH 2	3.0	1,100	800 to 1540	1	2.2	2.4	3.0
15 AH 3	4.0	1,500	1200 to 2100	1	3.0	3.3	3.9
21 AH 4	5.5	2,100	1680 to 2940	1	4.1	4.5	5.1
31 AH 6	8.1	3.100	2480 to 4340	1	6.0	6.3	7.2
36 AH 7	9.7	3,600	2880 to 5040	1	7.3	8.2	9.2
47 AH 9	12.7	4,700	3760 to 6575	2	9.4	10.1	11,3
62 AH 13	16.9	6,250	5000 to 8750	2	12.5	13.3	14.5
79 AH 16	21.4	7,900	6325 to 11100	2	15.8	18.8	20.2
108 AH 22	29.4	10,800	8700 to 15500	2	21.8	24.0	25.6
118 AH 24	31.7	11,850	9500 to 16600	2	23.7	27.4	29.3
146 AH 29	39.4	14,600	11657 to 20200	2	29.2	32.0	34.0
177 AH 35	47.8	17,700	14150 to 24800	2	35.4	38.3	40.3
238 AH 48	64.2	23,800	19000 to 33200	2	47.5	49.0	51.4
290 AH 58	78.4	29,000	23200 to 40500	2	57.9	61.0	63.8
340 AH 68	91.8	34,000	27200 to 47750	3	68.0	75.7	78.5

*Nominal Tons are based on Entering Air conditions of 80° D.B., 67° W.B.; Leaving air conditions of 60.2° D.B., 56.8° W.B.; 4-row coil; 500 FPM face velocity; 40° refrigerant temperature; standard coil face area with 7 fins per inch. For capacities with other coil sizes or fin spacings, refer to Bulletin AHU-100.

†For standard coil face area.

MODEL NO. CODE

11 H AH 2

2 sq. ft. of face area

Air Handler

Horizontal Cabinet (V for Vertical)

1100 CFM @ 500 FPM at standard conditions

EXAMPLE of capacity range:

Model 47AH9 at standard air and refrigerant conditions

CFM ranges from 3,760 to 6,780. Face areas available are 9.4, 10.1, 11.3 sq. ft.

Cooling coil depth from 3 to 8 rows; heating coil depth, 1 or 2 rows. Fin spacing of 6, 7, 8 or 10 fins per inch.

Minimum capacity is 8.93 tons

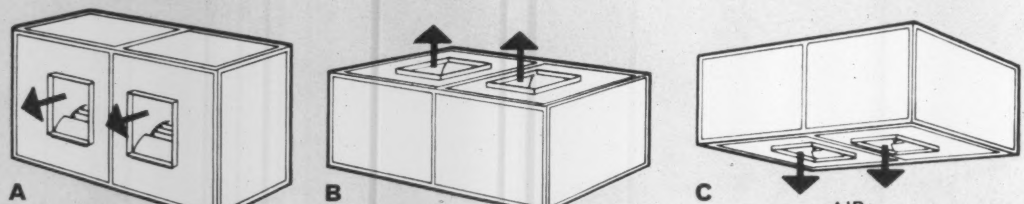
Based on 400 FPM, 3,760 CFM, 3-row cooling coil, 6 fins per inch, 9.4 sq. ft. face area.

Maximum capacity is 28.1 tons

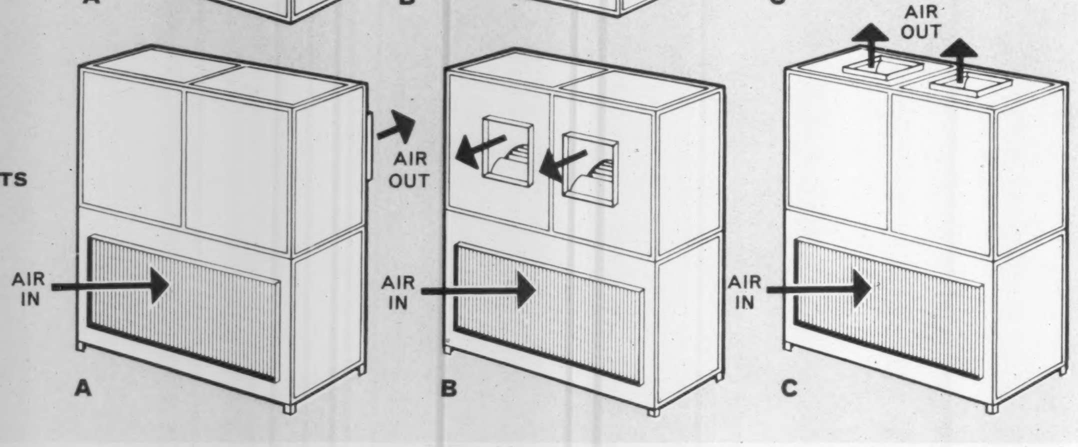
Based on 600 FPM, 6,780 CFM, 8-row cooling coil, 10 fins per inch, 11.3 sq. ft. face area.

CHOOSE THE MOUNTING ARRANGEMENT YOU WANT:

HORIZONTAL UNITS

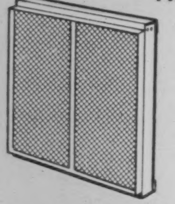


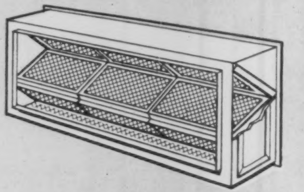
VERTICAL UNITS



CHOOSE THE ACCESSORIES YOU NEED:

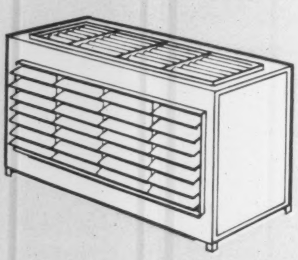
FILTER SECTIONS


HIGH VELOCITY

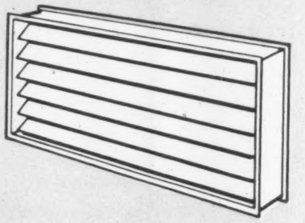

LOW VELOCITY

(throw away or cleanable filters may be used with either type section)

MIXING BOXES



FACE and BYPASS DAMPERS



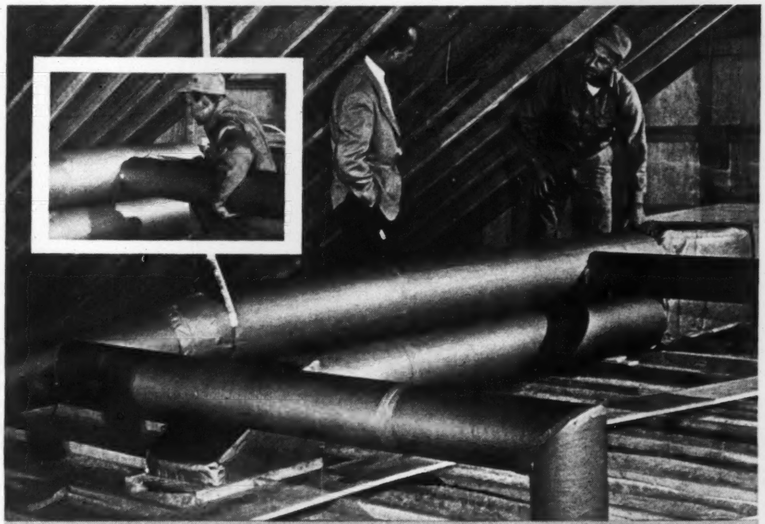
BULLETIN AHU-100 CONTAINS COMPLETE PRODUCT INFORMATION. WRITE FOR A COPY AND FOR PRICES

HALSTEAD & MITCHELL CO. • BESSEMER BLDG. • PITTSBURGH 22, PA.

J-0531 Litho in U.S.A.

- *from TV stations to garden apartments...*

"Prefab" Glass Fiber G-B Duct Proves Ideal for Commercial Duct Systems!



CHICAGO FLORAL SHOP—A substantial reduction in electrical bills convinced the operators of this floral shop that there's nothing better than G-B DUCT for air conditioning duct systems. The uniformly-thick, seamless walls of G-B DUCT hold heat gain to a minimum, thus allowing the cooling equipment to operate more efficiently.

CLEVELAND TV STATION—Elimination of noises was a must in this remodeling job which included a new air conditioning and heating system. Acoustically efficient G-B DUCT was the logical choice for the ductwork. Its all-glass-fiber construction soaks up noises before they're ever heard.

KANSAS CITY GARDEN APARTMENTS—Economy and speed of installation were two reasons why G-B DUCT was selected for this commercial duct job. Completely prefabricated at the factory, G-B DUCT comes in round 6′ ready-to-use sections that can be installed in almost half the time required for insulated metal duct.

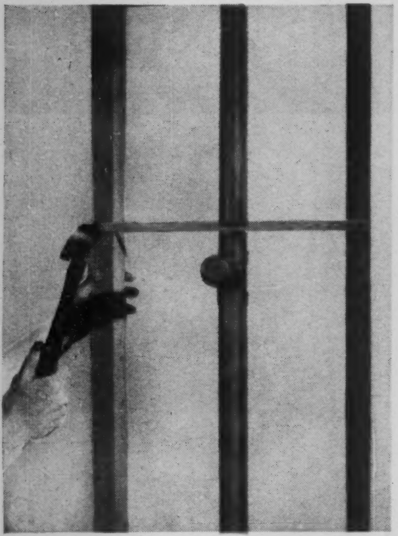
LOS ANGELES MEDICAL CENTER — Prevention of "cross-talk" noise between doctors' offices was one of the primary reasons for selecting G-B DUCT for this commercial duct installation. Because G-B DUCT is made entirely of insulation, encased in a vapor barrier sleeve, acoustical and thermal protection are "built-in".

Everything about this prefabricated glass fiber duct makes it ideal for commercial, institutional, as well as residential use. For additional product information, installation instructions and sample specs, write today.

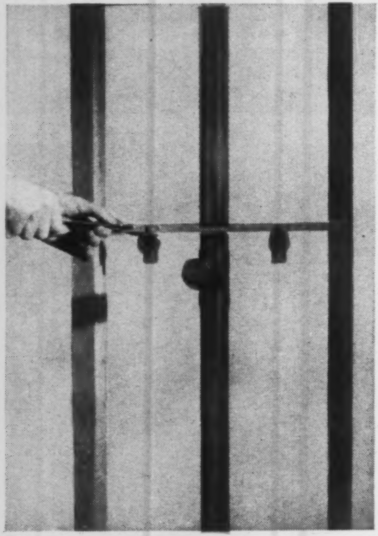
GUSTIN-BACON *Manufacturing Company* gb

220 W. 10th St., Kansas City, Mo.

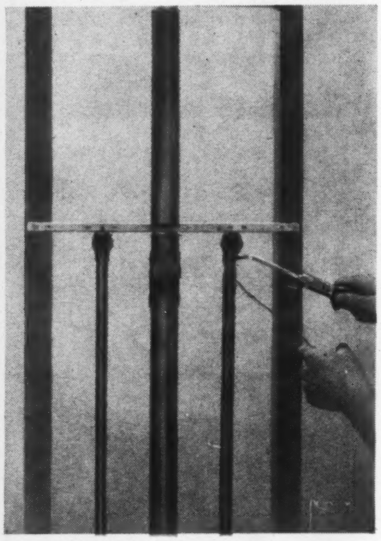
NEW ANACONDA COST-CUTTING KITS—to help you rough in hot and cold water lines FASTER, EASIER, BETTER



1. Nail strap to studs—no blocking, no sawing, no notching to avoid vents.



2. Fasten fittings to the perforated strap with self-tapping screws.



3. Solder the fittings to the risers—and the installation is complete.

Kits for every need

90° ELLS

1707-3-5A	Copper to F.S.P.S.	⅜"
1707-3-5A	Copper to F.S.P.S.	½"
1707-3-5A	Copper to F.S.P.S.	½" x ⅜"
1707-5A	Copper to Copper	½"

TEES

1711-5A	Copper to Copper to Copper	½"
1712-5A	Copper to Copper to F.S.P.S.	½" x ½" x ⅜"
1712-5A	Copper to Copper to F.S.P.S.	½"

THRU-WALL ADAPTER

1703-5A	Copper to F.S.P.S.	½"

Convenient—Reasonably Priced

USE
QUIK-RUF KIT
ANACONDA
ANACONDA HIGH EAR ELLS
COPPER TUBE & FITTINGS

EACH ANACONDA QUIK-RUF KIT CONTAINS: 10 Anaconda High Ear Fittings, 6 Stud Straps, 20 Self-Tapping Screws, and 12 Nails.

These new Anaconda Quik-Ruf Kits are sold by distributors of Anaconda Copper Tube and Fittings. The prices are right. So get a stock of kits now and start saving time and money right away.

6002 L

ANACONDA®

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

COPPER TUBE AND FITTINGS

Anaconda American Brass Company

one p-k scalefree 230* used for—

1 - supplying all domestic hot water
2 - for baseboard radiant heating
3 - for reheat in air conditioning system

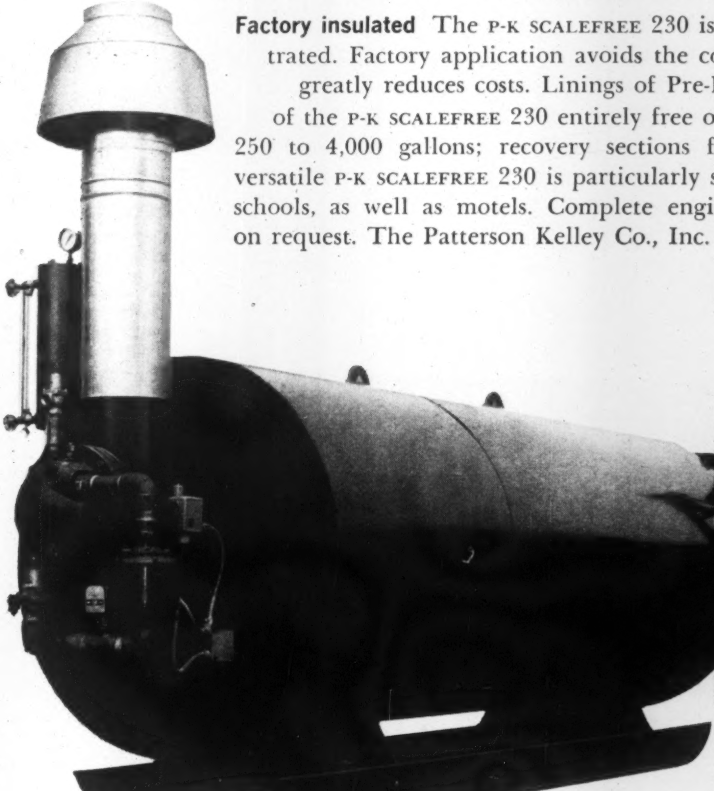
CAROUSEL
MOTEL
RESTAURANT

To supply all the hot water required for domestic service, baseboard heating, and reheat in air conditioning system, owners of the handsome Carousel Motel and Restaurant selected the new P-K SCALEFREE 230 . . . the industry's first indirect gas fired storage water heater. » » » High among reasons for choosing the P-K SCALEFREE 230 — It won't scale, and retains its rated efficiency, because heat transfer occurs below the temperature at which scaling minerals precipitate.

Quickly installed A complete and automatic package, the P-K SCALEFREE 230 can be skidded into place, hooked up and checked out quickly. There is no complicated piping or electrical work to run up installation costs. No stack is needed for extra draft. No foundation is necessary.

Factory insulated The P-K SCALEFREE 230 is available with factory insulation as illustrated. Factory application avoids the complications of on-the-site insulating and greatly reduces costs. Linings of Pre-Krete® or copper keep the storage section of the P-K SCALEFREE 230 entirely free of corrosion. Storage capacities range from 250 to 4,000 gallons; recovery sections from 390,000 to 2,215,000 B.T.U. The versatile P-K SCALEFREE 230 is particularly suited to office buildings, institutions and schools, as well as motels. Complete engineering and performance data available on request. The Patterson Kelley Co., Inc.

Patterson Kelley
Water Heater Division
102 Morgan Avenue, East Stroudsburg, Pa.



Heating-Air Conditioning Contractor, Kingston Electric Co., Kingston, Pa.

The Carousel Motel and Restaurant, with a capacity of 600 persons, recently opened at Wilkes-Barre, Pa., is owned by William Heck, William Heck, Jr., and Thomas Heck. They chose the P-K SCALEFREE 230 because it offered ideal performance and economy features for a service business such as theirs. The Pre-Krete lined unit has a storage capacity of 500 gallons, and a recovery rate of 325 gallons per hour from 40°F to 140°F.

*Patent pending

Effective heating and cooling depends on a constant supply of water . . . in the right quantities . . . at the right temperature. That's why Weinman Pumps are specified as an integral part of the heating and air conditioning systems designed into today's buildings. Engineers and architects, alike, know Weinman's line of centrifugal pumps is their best assurance of pumping performance to meet precise requirements. Maintenance engineers, too, prefer Weinman pumps for rugged durability, easy maintenance and dependable, 'round-the-clock service.

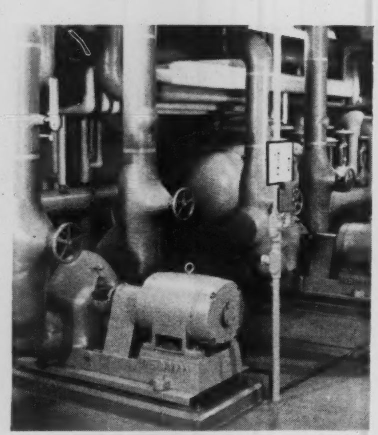
WEINMAN
ION

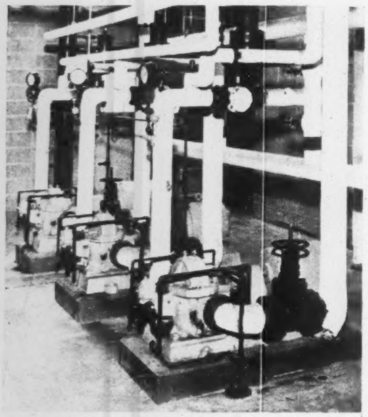
Across the nation...

WEINMAN IS THE STANDARD IN PUMPING PERFORMANCE

IN OHIO

The world's largest electrically powered air source heat pump, at the Columbus and Southern Ohio Electric Company, depends on 12 Weinman Pumps for circulating all liquids through the system.



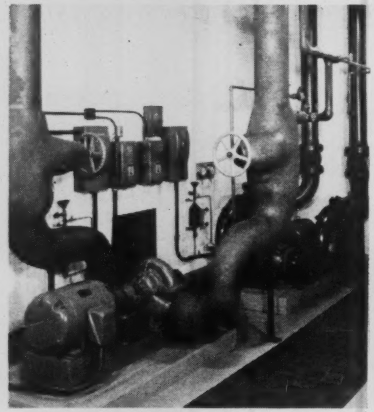


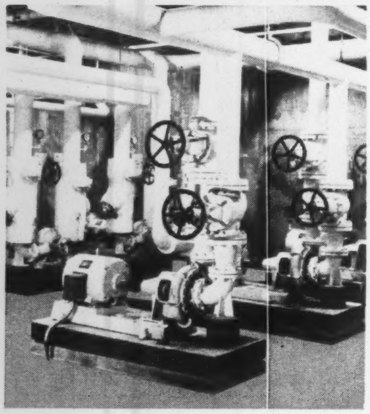
IN PENNSYLVANIA

A battery of Weinman Pumps delivers water from a central heating plant to the 30 building complex of the new state-operated Institution for Defective Delinquents in Luzerne County.

IN MISSOURI

Seven Weinman Pumps move hot and chilled water through the air conditioning system; remove sewage and deliver water to a decorative pool and waterfall at Old American Insurance Company's new Kansas City headquarters.



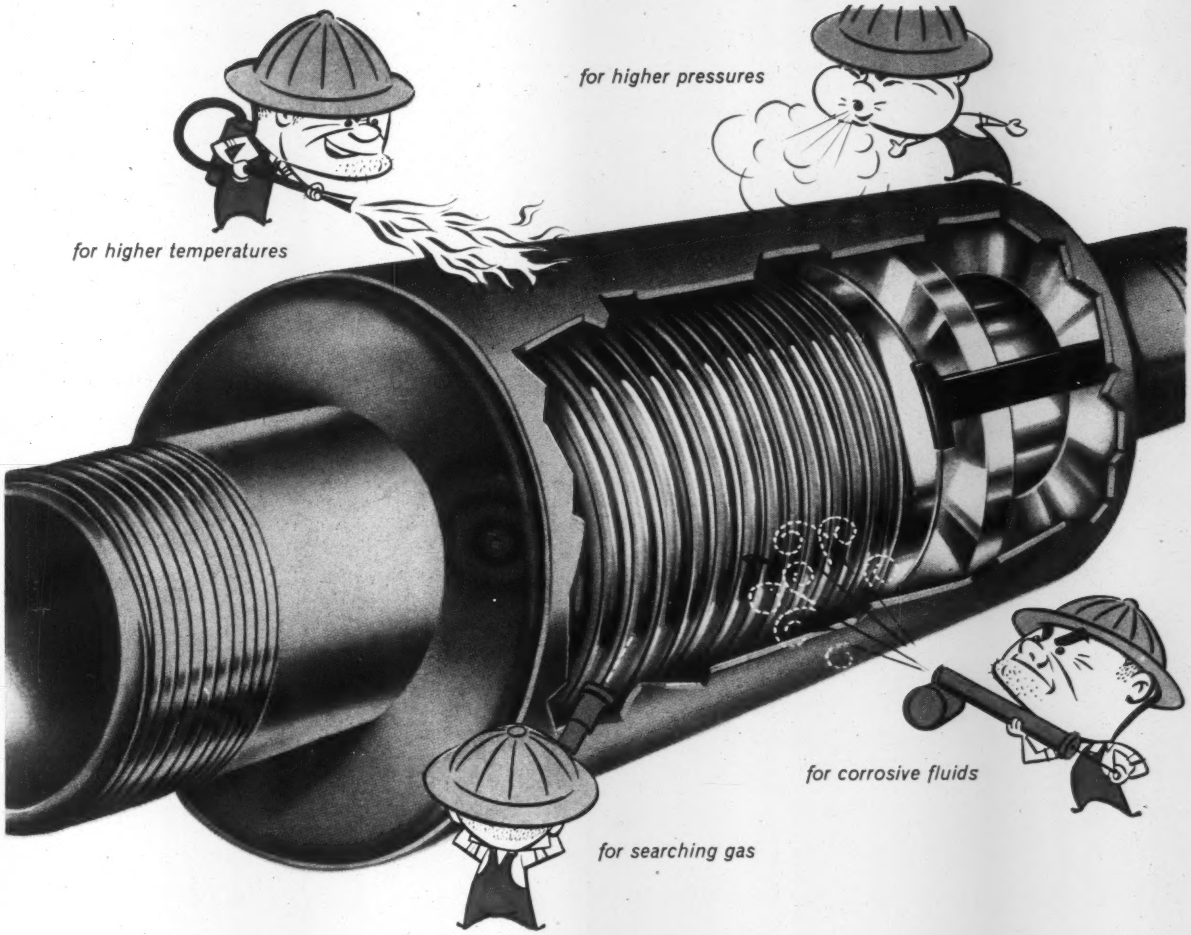


IN COLORADO

Denver's First National Bank Building gets efficient handling of condenser and chilled water for its air conditioning system with an installation of 6 Weinman Pumps.

Whatever your pumping need . . . there's a Weinman Pump to fit your precise specifications. For qualified recommendations consult your Weinman Specialist . . . he's in the Yellow Pages . . . or write direct.

THE **WEINMAN PUMP** MFG. CO.
290 SPRUCE STREET COLUMBUS 15, OHIO
CENTRIFUGAL SPECIALISTS



FLEXONICS MODEL HS EXPANSION COMPENSATOR NOW IN STAINLESS STEEL FROM TIP TO TIP!

Another important *first* from Flexonics! The original high-pressure, heavy-duty Expansion Compensator is now available entirely of stainless steel—to handle pipe expansion under conditions of higher pressure, higher temperature, corrosive fluids, chemicals and gases.

Screwed, welding, or flanged ends; heavy-duty two-ply Flexonics bellows; positive anti-torque design; and protective shroud . . . all are of stainless steel, to absorb up to 2" pipe expansion under corrosive conditions, at working pressures up to 175 p.s.i., temperatures up to 750°F. Pipe sizes ¾" to 3".

Inch for inch, this is your simplest, lowest-cost way to take up pipe motion under difficult operating conditions. Completely packless, it never needs maintenance. Designed to outlast the piping system you install it in. Also Model H—carbon steel construction with stainless steel bellows; and Model HB—all bronze.

Make Flexonics Expansion Compensators a cost-cutting part of your next piping job.

Mail the coupon today for NEW Engineering Guide No. 222-B.

expansion compensators

EC-140

Flexonics
corporation

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ont.

EXPANSION JOINTS · METAL HOSE · SYNTHETIC HOSE · BELLOWS · AERO/SPACE COMPONENTS

SUBSIDIARY OF CALUMET & HECLA, INC.

ATTACH TO YOUR LETTERHEAD—MAIL TODAY!

Flexonics Corporation
1391 South Third Avenue
Maywood, Illinois

Please rush me complete information on

- ☐ Expansion Joints
- ☐ Expansion Compensators
- ☐ Flexible Connectors
- ☐ Pipe Guides and Supports

Quality, Economy, Dependability

for slab perimeter jobs!

SONOCO

SONOAIRDUCT®

FIBRE DUCT

Concordia Lutheran Church, near China Grove, N. C.
Architect: Howard Bangle
General Contractor: Cabarrus Construction Company
Heating Contractor: Smith Air Conditioning, Concord, N. C.

There are good reasons why Sonoco SONOAIRDUCT continues to be America's *best selling* Fibre Duct—year after year. It's low in cost, saves installation time and labor, and has proved to be a dependable performer in hundreds of slab perimeter heating cooling systems.

Contractors like working with SONOAIRDUCT—its light weight makes handling a cinch, it joins and levels quickly, and it can be cut or mitered easily with a hand saw. There are no dangerous sharp edges, either, and SONOAIRDUCT won't chip, crack or break when dropped—every piece is usable!

You are assured of highest quality too, because aluminum foil-lined SONOAIRDUCT meets or exceeds all F.H.A. criteria and testing requirements for products in this category. And every shipment must pass Sonoco's rigid quality inspection.

Sonoco SONOAIRDUCT—the Fibre Duct with more Q. E. D.—saves both contractors and owners time, labor, money. Available in 23 sizes from 2" to 36" I.D. in standard 18' lengths. Special sizes to order.

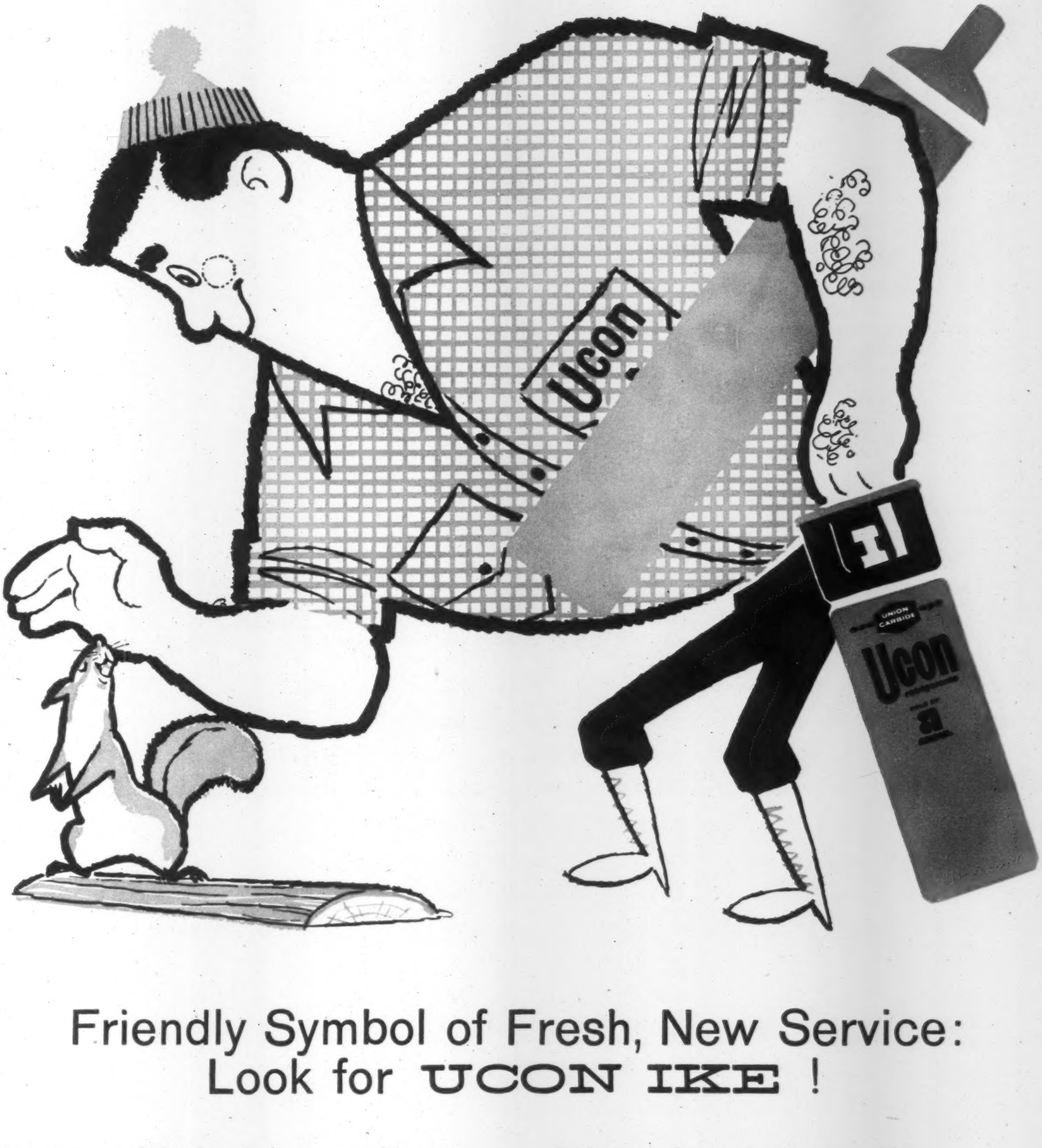
For complete information,
see our catalog in Sweet's or write

SONOCO

Construction Products

SONOCO PRODUCTS COMPANY, HARTSVILLE, S. C. • La Puente, Calif. • Fremont, Calif. • Montclair, N.J. • Akron, Indiana • Longview, Texas • Atlanta, Ga. • Ravenna, O. • Brantford, Ont. • Mexico, D.F.

5168



Friendly Symbol of Fresh, New Service: Look for UCON IKE !

UCON IKE stands for America's newest refrigerants—top-quality UCON Brand Refrigerants. *Plus* a brand-new approach to service . . . backed by a published marketing policy.

You'll like the people who make this policy work for you. They're friendly, competent, imaginative people, who know and care about your problems.

The service they provide is what makes the *real* difference in refrigerants!

UCON Refrigerants: 5 top-quality grades; full range of unit sizes; color-coded at the top; personalized service.

UCON Brand Refrigerants are manufactured by
UNION CARBIDE CHEMICALS COMPANY—Division of Union Carbide Corporation
30 East 42nd St., New York 17, N. Y.
Exclusive Sales Agent to Air Conditioning and Refrigeration Wholesalers
ANSUL CHEMICAL COMPANY, Marinette, Wisconsin

UCON and UNION CARBIDE are registered trade marks of Union Carbide Corporation

a UNION CARBIDE product
Ucon BRAND refrigerants
exclusive sales agent
ANSUL

SPORLAN
Famous Firsts...
Catch-All

...for Peak Performance Air Conditioning!

Sporlan *Catch-All* . . . the first molded porous core filter drier . . . Sporlan's amazing ***See•All*** the first combination moisture and liquid indicator . . . Sporlan Solenoid Valves with the layer wound Blue Seal Coil . . . Sporlan Thermostatic Expansion Valves with the original ***FLOWMASTER*** element and Refrigerant Distributors with the versatile interchangeable nozzle . . .

*offer **You** a perfect combination engineered to fit any size installation... right down the line!*

Ask your friendly Sporlan Wholesaler for your copy of Condensed Catalog 58 today!

SPORLAN
Peak Performance products
Condensed Catalog No. 58
SPORLAN VALVE COMPANY

SPORLAN VALVE COMPANY

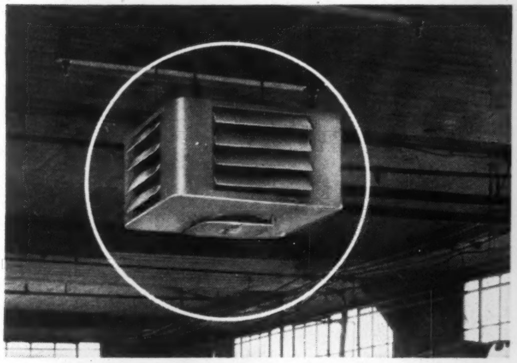
7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI

EXPORT DEPT: 85 BROAD ST., NEW YORK 4, N. Y.

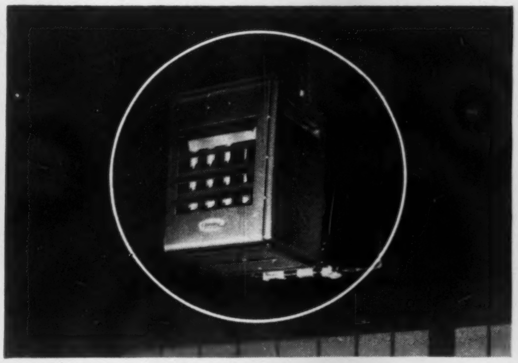
Which is the best way to heat a building?

It depends on the building. The size, the purpose, and the source of heat available can make a big difference. That's why Carrier offers such a wide selection of types and sizes of heaters, and that's why your Carrier agent is the man to work with. Since the Carrier Unit Heater line includes almost every type of commercial or industrial heating equipment, his only interest is to supply you with the type that serves you best in every kind of installation. You'll find him listed in the Yellow Pages under "Heaters – Unit." Carrier Air Conditioning Company, Syracuse, New York.

FOR SMALL BUILDINGS...

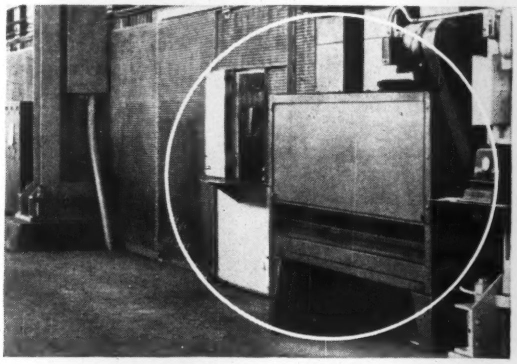


With steam or hot water, choose Carrier 4-Way Unit Heaters. Truly versatile, just one of these exclusive "Clover Leaf" models can do the job of two or more ordinary heaters. Carrier also offers horizontal, vertical and cabinet style unit heaters.

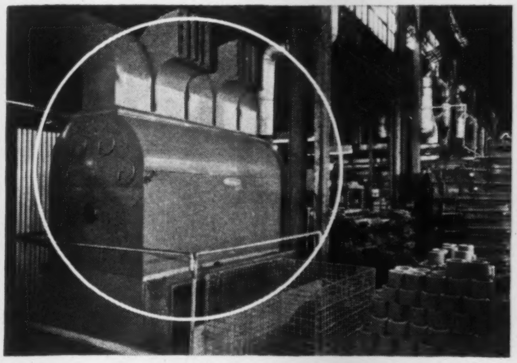


With gas, choose Carrier Gas-fired Unit Heaters or Duct Furnaces . . . featuring heat exchangers made of Strato-steel® for long, dependable service. New large size duct furnaces available for heating in conjunction with air conditioning.

FOR LARGE BUILDINGS...



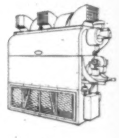
With a central source of heat, choose Carrier Heat Diffusers or Heating and Ventilating Units. Heavy duty blowers, coils, housings and outlets may be individually selected to make up units that perfectly match your heating requirements.



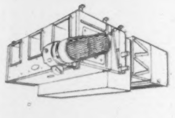
Where there is no boiler, Carrier Heat Diffusers, Direct Fired, offer the most economical method of heating large areas. Completely self-contained, and factory assembled, they need only fuel and power connections to be put in operation.

Carrier offers every type of equipment for any commercial or industrial job

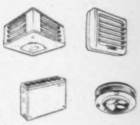
Carrier



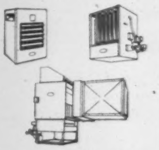
Heat Diffusers – Direct Fired for gas or oil



Heating and Ventilating Units for steam and hot water



Unit Heaters for steam and hot water



Gas Unit Heaters and Duct Furnaces

Allied forms new

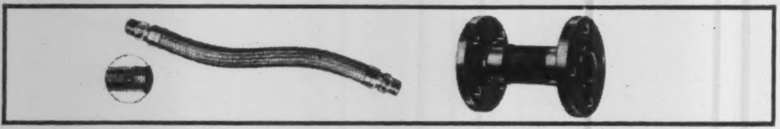
Heating, Airconditioning, & Piping Division to serve specifiers, installers, & users of Flexible Pipe Connectors

OFFERS COMPLETE ALLFLEX SERVICE FOR CONTROLLING PIPELINE MOTION IN HEATING, COOLING, & PLUMBING SYSTEMS

Immediate, experienced, on-the-spot service in solving pipeline problems caused by vibration, thermal expansion, and misalignment is now offered by Allied Metal Hose Company's new "H.A.P." Division, the latest specialized unit created under the firm's continuing expansion program.

The new division will serve Mechanical Engineers and Contractors thru a nationwide network of factory trained pipe-motion-engineering sales specialists, according to an announcement by Fredric R. Cahn, the company's Director of Sales.

Backed by ALLIED's extensive engineering and custom-fabrication facilities, these specialists are now at the disposal of heating, cooling, & plumbing engineers, contractors, distributors and jobbers who design, specify, furnish, or install piping for pumps, compressors, turbines, condensers, cooling towers, radiators, or other fluid or air handling machinery in commercial and industrial building.



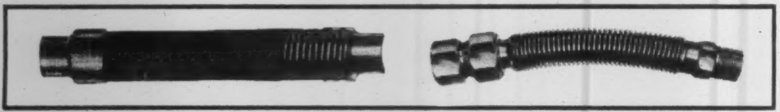
Typical H.A.P. Flexible Pipe Connectors include:

A) H.A.P. FLEXible PIPE-to-pump Connectors,
B) H.A.P. FLEXible COMPressor-to-pipe Connectors,
C) ALLFLEX VIBRATAMERS

Installed at suction and discharge ports of pumps and compressors to absorb, attenuate and isolate vibration, preventing its full transmission to the pipeline; absorb & compensate for dimensional changes caused by temperature induced pipeline contraction & expansion; and to take up slight pipeline misalignment. H.A.P. connectors minimize unbalance and excessive wear, insuring longer pump and compressor service life, and reducing maintenance time and cost.

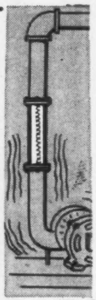
These connectors consist of a corrugated and braided flexible tube, with Threaded, Flanged, Tube or Pipe ends. Furnished in all standard sizes — thru 16 in. in Stainless Steel, 8 in. in Bronze & Hot-dip-galvanized Steel, and 4 in. in Monel (an ALLIED "first").

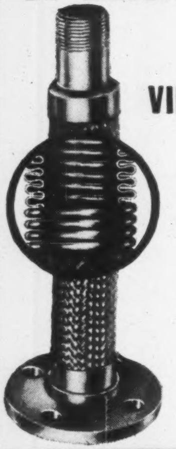
D) H.A.P. Expansion Compensators, Absorb and take up pipeline expansion at right angles to the direction of movement. Designed to meet specified working conditions, these expansion compensators come in a wide variety of constructions (including unbraided for low pressures).



For complete information, experienced assistance, and the name of the Allied HAP Division Representative in your area, Write, Wire or Phone
ALLIED METAL HOSE COMPANY, Long Island City 1, N.Y., STillwell 4-5173

CALM *Jittery* PIPELINES





ALLFLEX VIBRATAMERS!
Custom-Engineered
FAST to solve **your** problems.
In Stainless Steel, Bronze, Monel
write, wire, phone today for
"VIBRATAMER" DATALOG 601

ALLIED METAL HOSE CO.
3745 Ninth St., Long Island City 1, N.Y.
Telephone: STillwell 4-5173

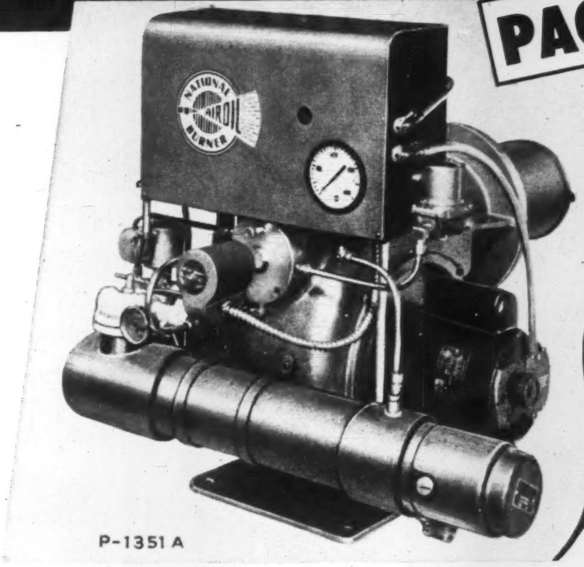
FLEXIDIZE
YOUR RIGID PIPELINE CONNECTIONS

Standard
ALLFLEX MNH
flexible pipe connectors
FROM STOCK
IN **STAINLESS STEEL**
MONEL • BRONZE
solve your pipeline flexation problem!
write, wire, phone today for your Allflex Datalog
611

ALLIED METAL HOSE CO.

3745 Ninth Street,
Long Island City 1, N.Y.
STillwell 4-5173

New! Proven! Approved! National Airoil Type C-45 Oil Burner PACKAGE



Pressure Atomizing Burner specially engineered and approved by Underwriters' Laboratories for use with Nos. 4 and 5 commercial fuel oils

For No. 2 oil, specify the C-20 oil burner, available in the same sizes and models as the C-45 oil burner, for natural or induced draft or "pressurized" boilers.

QUIET HEATING AT LOWEST COST IN BUILDINGS REQUIRING UP TO 12,000 SQUARE FEET OF RADIATION

RUGGED DESIGN AND PRECISION CONSTRUCTION

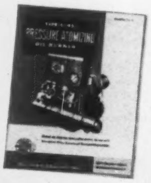
EASY TO INSTALL—MINIMUM INSTALLATION COSTS

EASY STARTING, HIGH TEMPERATURE FLAME, GOOD COMBUSTION

SPECIALLY DESIGNED FOR USE IN STANDARD FIRE BOX BOILERS OR IN THE LATEST TYPE SELF-CONTAINED BOILERS FOR NATURAL OR INDUCED DRAFT OR "PRESSURIZED"

EXCELLENT REPLACEMENT FOR LIGHT OIL BURNERS UP TO 33 GPH

Bulletin 100 contains complete data on the Type C-45 Oil Burner in its several natural or induced draft models and pressurized model. Write for a copy today.

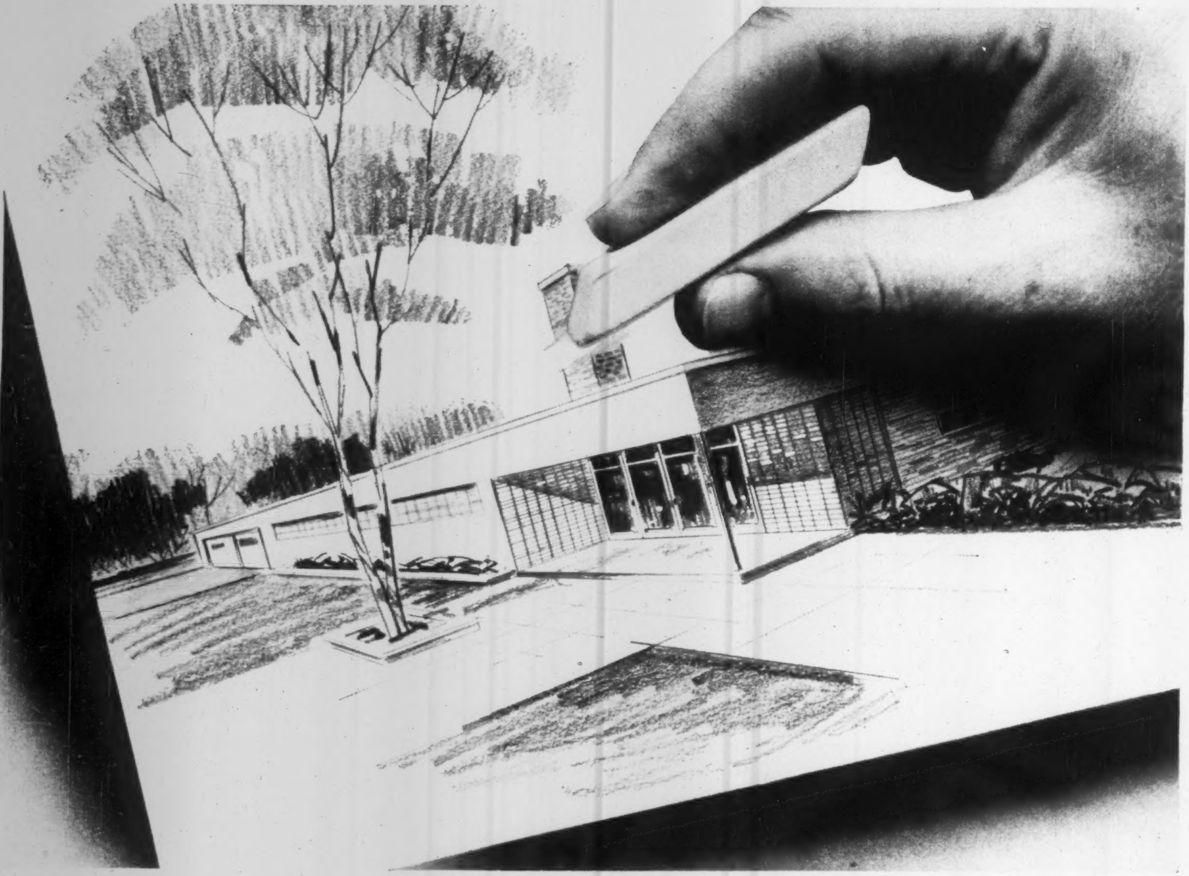


✓ CHECK THESE ADVANTAGES

- No float valves to stick open or closed.
- No oil level to maintain.
- No air compressor or multipistons to lubricate, maintain or replace.
- Simple standard parts.
- A unit that is easily understood and serviced by any good oil burner mechanic.
- As easy to install and service as a residential gun type oil burner.
- All controls, except limit switch and thermostat, are mounted in enclosed control cabinet, factory wired and tested, with terminal block coded for easy field connections.
- All air needed for combustion is furnished by burner blower—no secondary air openings are required.
- Prepurge of cold oil and delivery of hot oil, of proper viscosity, right at the nozzle, before burner start. This insures easy, smooth start every time.
- All valves and component parts are included.
- Electronic combustion safety controls, with response of 0.8 seconds on flame failure, provide utmost in safety and meet all requirements of Underwriters' Laboratories.

Established 1912
Incorporated 1917

NATIONAL AIROIL BURNER COMPANY, INC.
1284 E. Sedgley Avenue • Philadelphia 34, Pa., U.S.A.
Industrial Oil Burners, Gas Burners and Combustion Equipment



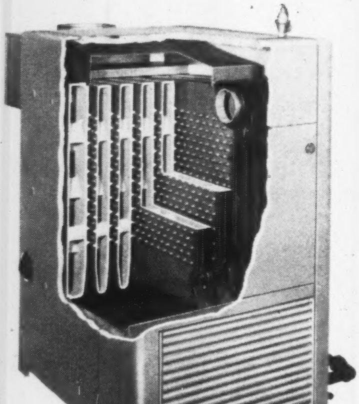
FORGET THE CHIMNEY WHEN YOU SPECIFY A WEIL-McLAIN TYPE "J" GAS BOILER

The Weil-McLain Type "J" Cast Iron Gas Boiler does not need a high chimney which breaks up the smooth sweep and flow of modern architecture...nor is a draft fan necessary. It conforms to A.G.A. venting requirements...products of combustion can be expelled with only a 5 foot vent riser beyond the draft hood openings. Where building conditions require a longer vent, design and sizing data are available from Weil-McLain.

Other highlights of "J" Boiler design

1. A.G.A. approved efficiency of 80%.
2. Compact design saves boiler-room space—up to 50%.
3. A.G.A. approved for all gases.
4. Electronic controls and pre-wired control panels engineered as part of unit.
5. No refractories, motors, fans, tubes or water treatment.
6. Can be assembled at any stage of building construction.
7. 33 sizes in 500 gross sq. ft. increments permit close sizing.

Send for Bulletin C-297. For oil boiler information see Engineers' Product File or Sweet's Architectural File.



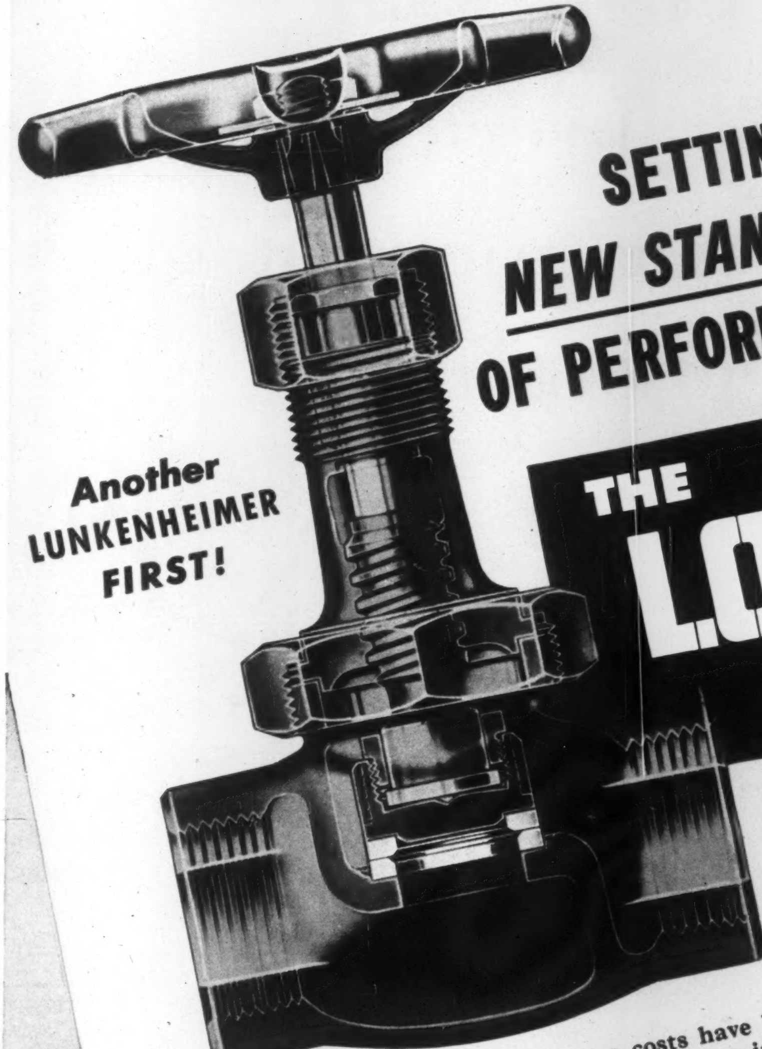
Type "J" Gas Boiler

Net I=B=R Ratings, steam and water, 360,100—3,354,000 BTU/hr.

WEIL-McLAIN

CAST IRON BOILERS

WEIL-McLAIN COMPANY • Dept. AA-110 • MICHIGAN CITY, INDIANA



Another LUNKENHEIMER FIRST!

SETTING NEW STANDARDS OF PERFORMANCE...

THE LQ600® VALVE

FIG. LQ600-200
200 lb. S.P.—550°F.—
400 lb. W.O.G.

FIG. LQ600-150
150 lb. S.P.—300 lb. W.O.G.

1/4 to 2 inches

Long-accepted valve maintenance costs have been sharply reduced in thousands of plants where LQ600 Valves are in service. Their patented Brinalloy® seats and discs are more resistant to wear and corrosion than 500 Brinell Stainless Steel . . . even outlast case-hardened Stainless Steel exceeding 1000 Brinell. LQ600 Valves practically eliminate maintenance costs . . . another big reason why you can't find the cost of a valve on a price list!

SEE YOUR LUNKENHEIMER DISTRIBUTOR
or write for literature
THE LUNKENHEIMER CO., CINCINNATI 14, OHIO

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

L-456-28R

With a draft diverter these are nothing but smoke stacks.

Specify instead a

FIELD DRAFT CONTROL

and they become true chimneys

. . . an abundant, unfailing source of draft, precisely controlled to the needs of gas combustion

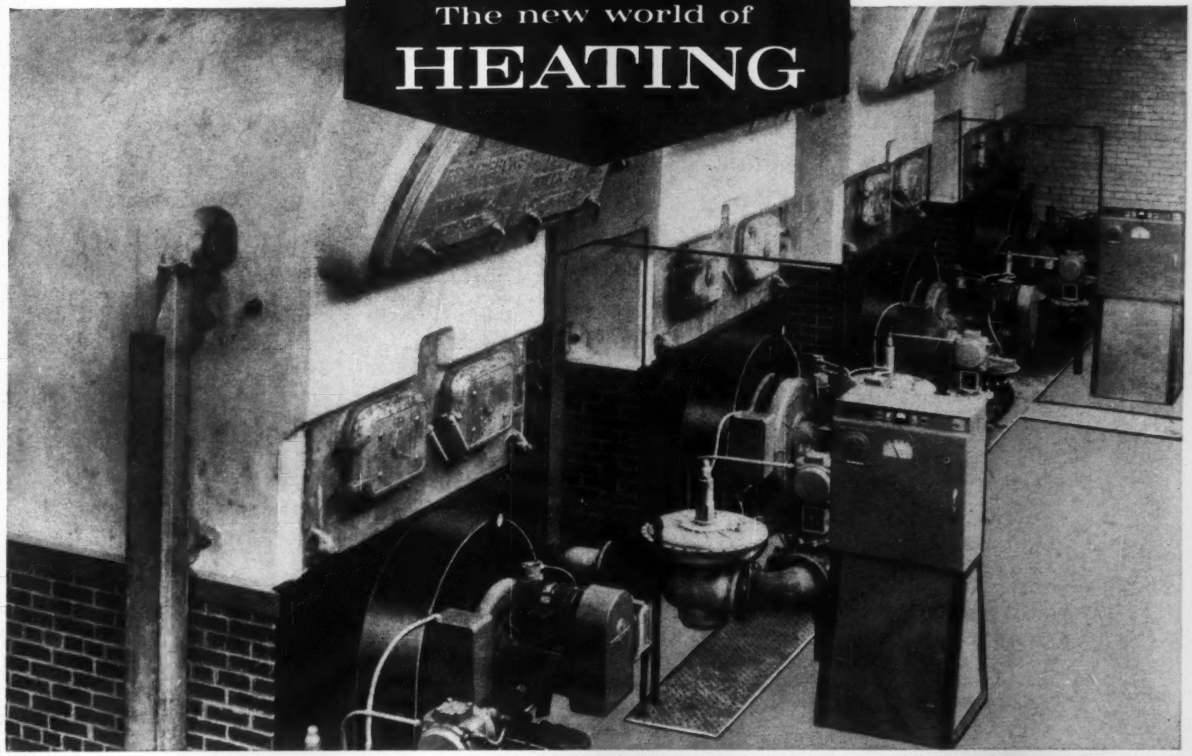
field

FIELD CONTROL DIVISION, Conco Engineering Works, Inc., Mendota, Illinois

AFFILIATES: Spartan Tool Division - Powered Sewer Cleaning Equipment - Material Handling Division - Cranes, Hoists - Conco [illegible] Products, Inc. - Brick, Tile, Stone

The new world of

HEATING



This Kansas high school heating plant uses four Iron Fireman dual-fuel burners with factory-built control panels.

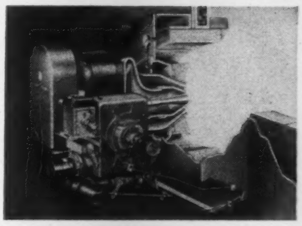
Add high efficiency firing *without boiler alteration*

Factory engineering replaces local "cut and try" firebox design

The Iron Fireman AirRing* dual-fuel burner (shown in the high school heating plant above) is a complete factory built package that is simply bolted to the boiler front.

The package includes both primary and secondary air systems, combustion safety controls, ignition and fuel systems for either one or two fuels, and factory engineered refractory combustion throat.

This compact unit not only reduces on-the-site construction, but achieves superior performance by supplementing local craftsmanship with experienced application engineering. Complete combustion is accomplished without flooding the firebox with excess air.



This cutaway shows how oil, gas and air are introduced into the combustion chamber through a single firing port. No checkered floor, firing arch or boiler pit. Flame is generated within a cone of air—no inefficient infusion of underfloor air.

**Trade-Mark*

Mail coupon for full information and specifications.

THE IRON FIREMAN

IRON FIREMAN

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRPLANE GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

Iron Fireman Mfg. Co., 3102 W. 106th St., Cleveland 11, Ohio
(In Canada, 80 Ward St., Toronto)

Please send complete technical description and specifications on Iron Fireman AirRing firing.

Name_______________

Firm_______________

Address_______________

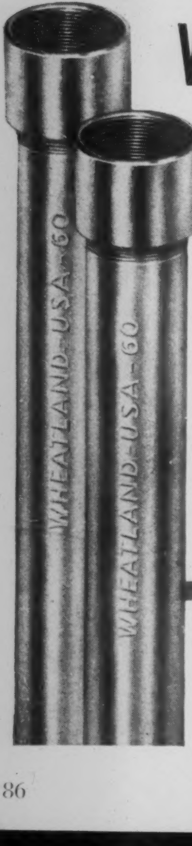
City_______________ State or Prov._______________

TEAMWORK PAYS OFF!

FOR YOU TOO!
Steel

...when you order your pipe through the

WHEATLAND PRODUCER-JOBBER TEAM



INSIST
ON PIPE
MADE
IN U.S.A.

You can be sure this winning combination will supply you with steel pipe of unvarying high quality, job after job. And your Wheatland distributor sees to it that you get the pipe you need . . . on time!

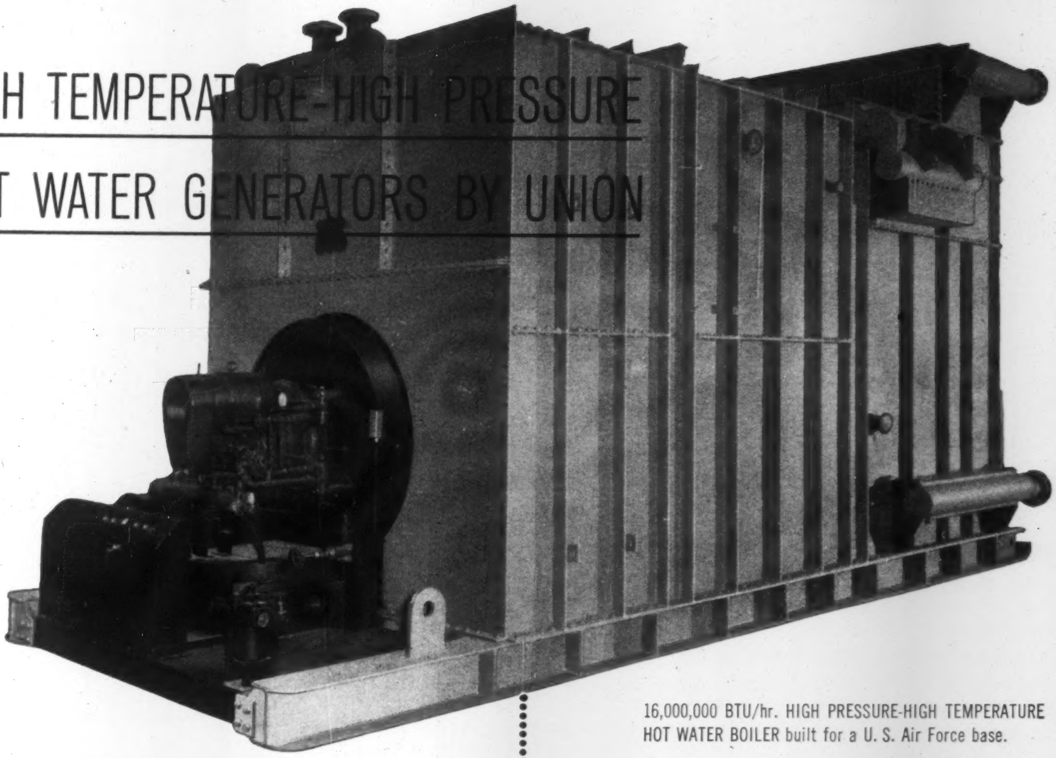
See your Wheatland Pipe Distributor for black or galvanized Wheatland Steel Pipe.

...pipe with the yearmark!

WHEATLAND STEEL PIPE

WHEATLAND TUBE COMPANY
Bankers Securities Bldg., Phila. 7, Pa.
MILLS: Wheatland, Pa. • Delair, N. J.

HIGH TEMPERATURE-HIGH PRESSURE HOT WATER GENERATORS BY UNION



16,000,000 BTU/hr. HIGH PRESSURE-HIGH TEMPERATURE HOT WATER BOILER built for a U. S. Air Force base.

SHOP ASSEMBLED UNITS INSTALLED WITHOUT COSTLY FIELD BALANCING

Right from the start, you can save with a Union shop assembled HTHP Hot Water Generator. With all of its circuits of the same hydraulic length, time consuming field balancing can be eliminated. Most units do not require orifices or any other mechanical adjustments to equalize flow at the time of installation.

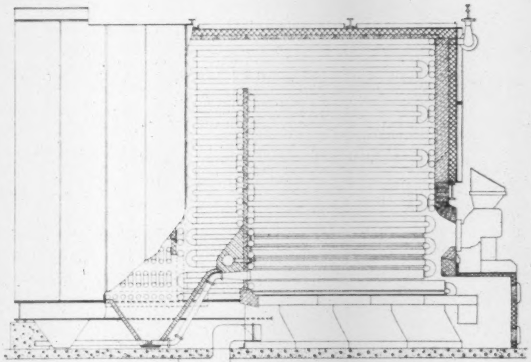
High water velocities (above 5 ft./sec.) and liberally proportioned, water cooled furnaces eliminate localized overheating. As there are no multi-tube circuits in the radiant section, recirculation within a circuit is impossible, thereby eliminating vapor binding or stagnant flow areas.

Liquid and gas flow run counter to each other. With the liquid inlet positioned at the top of the convection section, the lowest temperature liquid is served by the lowest temperature gas. As a result, generator efficiency is improved and the risk of thermal shock minimized.

Standard units (both shop assembled and field erected) can be modified to meet a wide range of job requirements. They can be arranged for firing with most commercial fuels as well as waste fuels in liquid, gaseous or solid form.

For specific information, outline your requirements to a Union representative or contact Union Iron Works.

UNION IRON WORKS • ERIE, PENNSYLVANIA



31,000,000 BTU/hr. FORCED CIRCULATION, HIGH PRESSURE-HIGH TEMPERATURE HOT WATER BOILER. Equipped for firing by an oscillating grate spreader stoker with fly ash reinjection. Fully factory-assembled for shipment.

UNION

water tube steam generators and allied equipment

Some Straight Talk On Steam Trap Capacity

. . . or pulling away the curtain of confusion that surrounds steam trap capacity ratings.

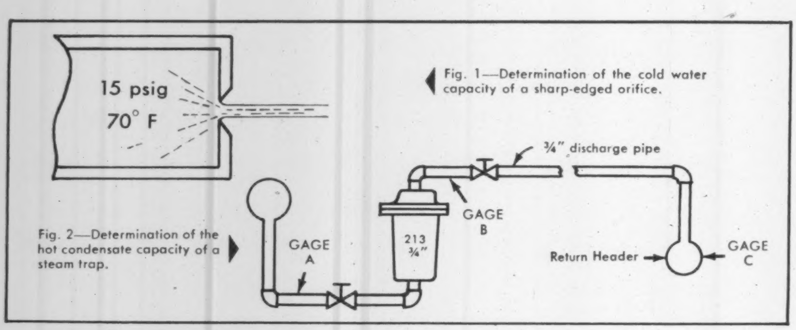


Fig. 1—Determination of the cold water capacity of a sharp-edged orifice.

Fig. 2—Determination of the hot condensate capacity of a steam trap.

Unfortunately, for the steam trap buyer, the subject of steam trap capacity has become cloudy and confused by a landslide of claims, counterclaims and inconsistent "standards" for measurement. So let's take a cold hard look at this subject so vital to the efficient operation of your plant.

What Determines Steam Trap Capacity?

There are three factors that determine the capacity of a steam trap:

1. The area of the orifice.
2. The density of the condensate.
3. The pressure differential across the trap.

Let's take a closer look at each of these:

Area of orifice is usually specified by the trap manufacturer or can be calculated from the diameter. Nothing complicated here.

Density of condensate depends on temperature. A cubic foot of cold water weighs 62.4 lbs. At 250° F. or 15 psi, it weighs less than 59 lbs. This is important. Don't overlook it.

Pressure differential across the trap is most significant. And it is complicated by the many factors that affect it, such as:

1. Pressure drop between unit drained and the trap when the trap valve is open.
2. Distance the trap valve is moved from the valve seat.
3. Back pressure on the trap with orifice closed; i.e., return header pressure.
4. Increase in back pressure produced by condensate and flash steam flowing in the discharge line. This in turn is affected by the diameter and length of the discharge line, plus friction caused by valves and fittings.

Orifice Capacity Vs. Steam Trap Capacity

Figure 1 shows a ½" diameter sharp-edged orifice at the end of a pipe filled with cold water at 15 lbs. pressure. The capacity of this orifice, using a .61 coefficient of flow would be 8,800 lbs. per hr. Now, would this ½" orifice if used in a ¾" steam trap installed as shown in Figure 2 provide the trap with a continuous discharge capacity of 8,800 lbs. of hot condensate per hour? The answer is "no". And here are some of the reasons why:

Density of condensate. As pointed out above, cold water weighs 62.4 lbs. per cu. ft. At 15 lbs. pressure and 250° F. water weighs less than 59 lbs. per cu. ft. This difference in density alone reduces the lbs. per hour capacity of the orifice by over 5%.

Pressure differential across the trap. With the trap valve closed we have a static pressure differential of 15 psi. The trap valve must be able to open against this pressure. However, this is not the pressure differential that will determine the capacity of the trap valve.

The ¾" discharge line will be full of a mixture of flash steam and condensate. To keep this mixture flowing from the trap outlet to the return line requires a pressure differential. In actual capacity tests run as shown in Figure 2 Gage B at the trap outlet registered 11 lbs. back pressure. Thus the true pressure differential across the trap was about 4 lbs. Under these conditions the measured capacity of the trap was 4,340 lbs/hr. or just about half of the capacity of the ½" orifice for cold water.

How Armstrong Determines Capacity Ratings

Armstrong trap capacity ratings are based on hundreds of tests under actual operating conditions. In these tests, the condensate used was at the steam temperature corresponding to the test pressure. Thus, the capacities determined take into account the pressure drop that occurs when the trap orifice opens and the choking effect and back pressure of the flash steam. Actual installation hookups were used so that pipe friction in both inlet and discharge lines as well was reflected in the results.

Let's go back to the example cited above and in Figure 2. The trap referred to is an Armstrong No. 213. While it did test out at 4,340 lbs. per hour for a static pressure differential of 15 psi, it is rated in the catalog at only 3900 lbs. per hour for this pressure—just to be on the safe side.

For the trap buyer, this means that Armstrong Steam Trap capacities are based on handling condensate at steam temperature for the stated static steam pressure differential under actual working conditions.

Capacity ratings which don't take into account all of the variables will be misleading and may lead to the selection of undersized traps. So whenever you specify or buy traps be sure that the capacity ratings you work from are realistic. One way to be sure is to select Armstrong Traps with *guaranteed* capacity ratings.

* * *

Additional information on trap capacity ratings, plus data on how to correctly size, install and maintain steam traps for any pressure, any temperature and any load, are presented in the 48-page Armstrong Steam Trap Book. Ask your local Armstrong Representative for a copy or write:

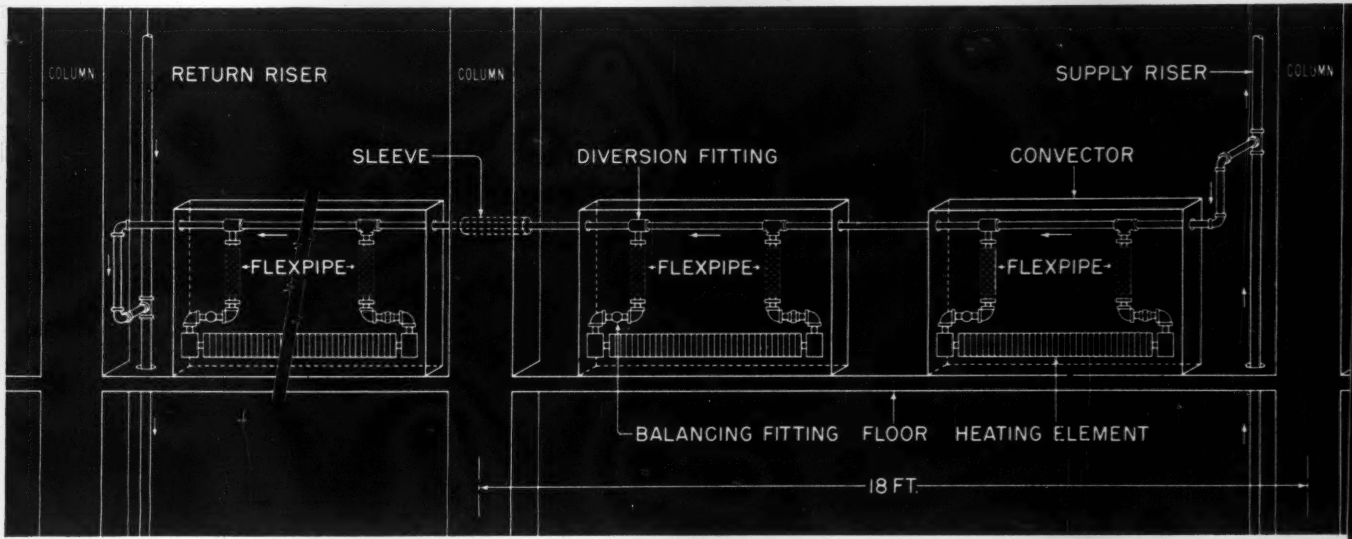
Armstrong Machine Works
8747 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS

See our Catalog in Sweets' Plant Engineering File

APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe



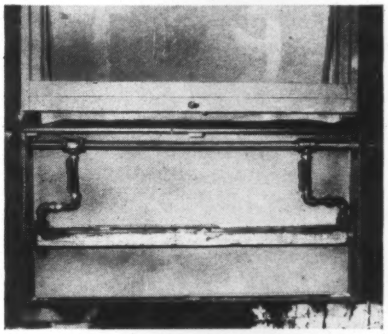
Heating system in Intensive Treatment Building, Norwich State Hospital. Architect: Lester Julianelle, New Haven, Conn. Consulting Mechanical Engineer: Hubbard, Lawless & Blakeley, New Haven, Conn. Plumbing & Heating Contractor: George Kaucher Co., Wolcott, Conn.

Flexpipe connectors at convectors provide big savings in pipe and fittings for hospital heating system

THE PROBLEM: To reduce the cost of installing the heating system in the 300-bed Intensive Treatment Building of the Norwich, Conn., State Hospital. The hospital was constructed under an appropriation of $5,000,000.

THE SOLUTION: Consulting mechanical engineers, Hubbard, Lawless & Blakeley of New Haven, devised a system using single horizontal mains passing through a number of convector cabinets in series. The runs go up to 70 feet, connecting as many as eight convectors. Each bay of approximately 18 feet has two convectors and the columns are sleeved to accommodate the mains. This arrangement, of course, greatly reduced the number of risers and fittings.

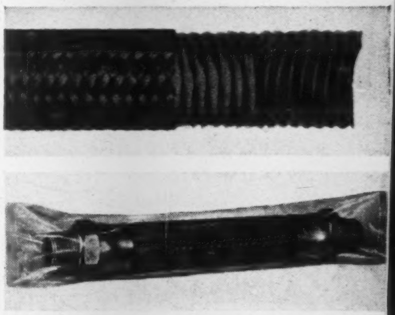
In the long runs, however, expansion is a big problem. So rigid connections at the convectors were out of question. Flexpipe connectors were used at the convectors as shown in the drawing above. The mains can expand and contract, with no strain on the heating elements. The savings planned were accomplished because both the quantity of pipe and the number of fittings are at an irreducible minimum.



One of the convectors in the Norwich State Hospital, showing how Flexpipe connectors are used to join the main and the heating element.

WHERE TO BUY: Flexpipe connectors come in convenient standard sizes from ¼ inch through 2 inch, and are sold by leading distributors throughout the country. For the name and address of the one serving your area, or for more detailed information, write to: Anaconda Metal Hose, P. O. Box 791, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

59154L



Flexpipe has core of flexible seamless tin bronze tubing. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Brass fittings attached. Packaged in clear, tough polyethylene bag for easy identification, handling and warehousing. Flexpipe connectors also available in larger sizes for pump and compressor connections. Write for Bulletin FP-4.

Flexpipe®
an
ANACONDA®
product

HISTORIC JACKSON, now a modern gas-cooled, gas-heated city! More and more of

Jackson, Mississippi, beats the heat

You can see dramatic evidence of the growing demand for low-cost *gas* air conditioning—when you check installations in Jackson. Here you'll find another high concentration of Arkla-Servel gas cooling . . . over 2400 tons in a city of 150,000 population.

Arkla-Servel gas equipment in Jackson includes scores of 25-ton absorption water chillers for larger buildings . . . and hundreds of the smaller Sun Valley All-Year gas air conditioners for residential and commercial use.

Key to the popularity of Arkla-Servel units in Jackson? Unbeatable economy and simplicity of operation for year-round air conditioning. They cool in summer, heat in winter, use one basic fuel . . . thrifty, safe, dependable *gas*.

Gas absorption cooling can put your customers' heating plants on a year-round paying basis. For

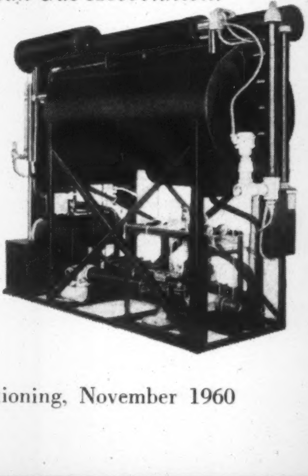
its buildings are installing Arkla-Servel equipment for year-round gas air conditioning.

with thrifty ARKLA-SERVEL GAS cooling

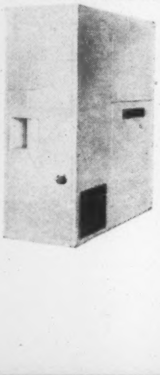
specific details on Arkla-Servel units, call your local Gas Company. Or write to Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Ark. *American Gas Association.*

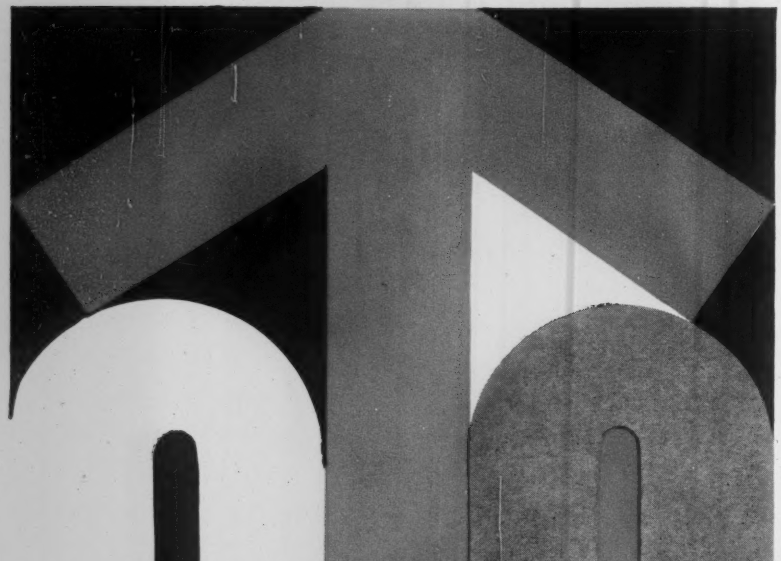
FOR HEATING & COOLING GAS IS GOOD BUSINESS!

ARKLA-SERVEL 25-TON GAS ABSORPTION UNITS use low-pressure steam from a gas-fired boiler as the source of energy for the chillers. They're compact, easy to install. They adjust automatically to heat loads, since steam input varies directly with capacity.



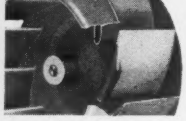
ARKLA-SERVEL SUN VALLEY 3½ AND 5-TON GAS AIR CONDITIONERS are compact central units that eliminate the need for individual fans, window air conditioners or separate cooling units. They cool, heat, clean, dehumidify and distribute air for year-round comfort at low cost.





%

AMCA
CERTIFIED
RATINGS



New Airfoil Bladed Fans exceed 90% efficiency

It's here now—a new line of Airfoil Bladed Fans from American-Standard Industrial Division . . . all carrying the AMCA certified rating seal! A completely new design, these Airfoil Bladed Fans employ a highly efficient, quiet fan configuration ideally suited for general ventilation and industrial process applications. High mechanical efficiency, over the entire fan selection range, means the lowest possible power requirements. Get the complete story. Send for Bulletin A-1103 today. American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Ltd., Toronto, Ontario.

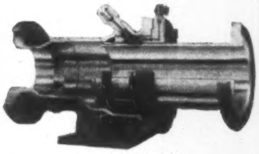
American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation

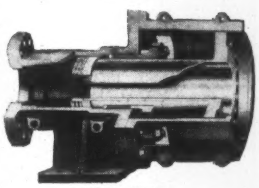
AMERICAN-Standard
INDUSTRIAL DIVISION
AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

having an Adsco time!

ONLY ADSCO HAS ALL 3 TYPES OF EXPANSION JOINTS

CORRUFLEX PACKLESS


RAM-PAK


SLIP TYPE

. . . real peace of mind, the result of doing business with completely reliable Adsco. For more than 80 years, Adsco has carefully handled customers' expansion problems in their piping systems, from engineering through manufacture. Consult Adsco for your peace of mind.

Write for comprehensive catalogs

ADSCO ENGINEERED PRODUCTS
Sold, Engineered and Manufactured by
YUBA HEAT TRANSFER DIVISION
HONESDALE, PA.
World's Oldest and Largest Manufacturer
of Packed and Packless Expansion Joints

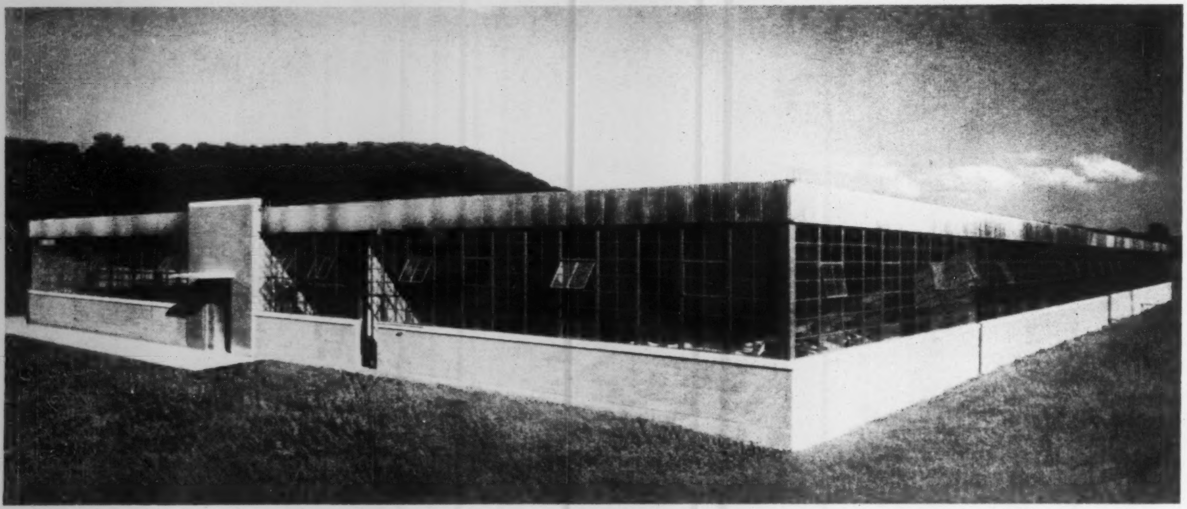
YUBA

YUBA CONSOLIDATED INDUSTRIES, INC.

YUBA — A growth corporation serving growth industries
chemical
petroleum
steam—electric
hydro—electric
aeronautics
construction
heating
air-conditioning
consumer durable

Campbell

WARM AIR HEATERS FOR LARGE BUILDINGS



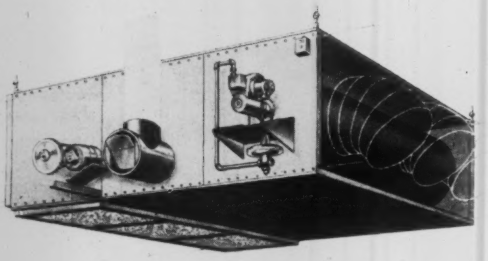
Connor Engineering Corp., Danbury, Conn. Two Campbell oil-fired units are suspended from ceiling. These two units with 2,200,000 BTU capacity are used as make up heaters which bring in and heat fresh air to replace exhausted air.

IDEAL FOR MAKE UP HEATERS

Cambell oil and gas-fired unit heaters are equally adaptable for use as make up heaters or to carry the full heating load in any large building. Available in both Horizontal and Hi-boy models, they are compact, quiet, exceptionally economical to operate and surprisingly low in cost. Campbell Heaters are available for all fuels in capacities up to 3,150,000 BTUs.

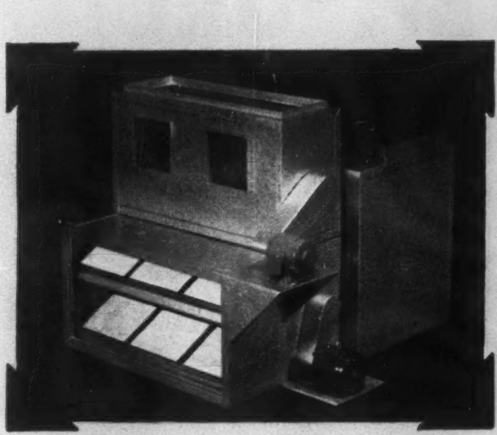
MANUFACTURERS' AGENTS

We have some attractive openings for men calling on heating contractors and architects.



CAMPBELL
HEATING COMPANY

Des Moines 17, Iowa



Dual Purpose Unit

IN THE BUENSOD FAMILY

of air conditioning apparatus

Although Buensod-Stacey is probably best known for its pioneering and development of dual-duct air conditioning system devices, that's not all we do. Far from it, the Buensod family of air conditioning products includes such items as Dual Purpose Units, air washers, automatic dampers, humidifiers and dehumidifiers, louvers, spray nozzles, and, of course, dual-duct and single duct units. Every one has been engineered to provide maximum on-the-job performance. There's probably a spot for Buensod equipment in your next installation. Write for complete information.

BUENSOD

BUENSOD-STACEY

Buensod-Stacey Corp., 45 West 18th Street • New York 11, N. Y.

Subsidiary of Aeronca Manufacturing Corporation

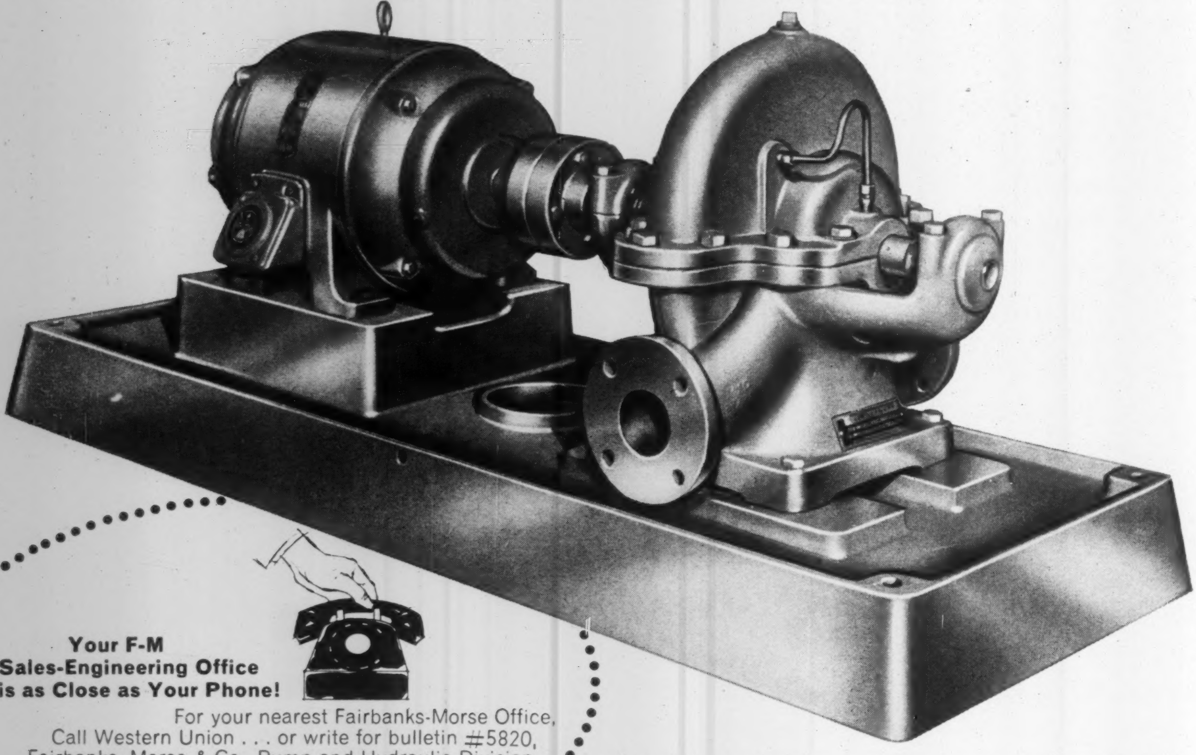
Fairbanks-Morse Announces!

A NEW SPLIT-CASE PUMP

FOR THE AIR CONDITIONING INDUSTRY

specifically designed for **MODERATE COST INSTALLATIONS**

Single Stage, Horizontal Split-Case Centrifugal Pump for Chilled Water, Circulating or Booster Duty; Cooling Towers or General Water Supply.



Your F-M Sales-Engineering Office is as Close as Your Phone!

For your nearest Fairbanks-Morse Office, Call Western Union . . . or write for bulletin #5820, Fairbanks, Morse & Co., Pump and Hydraulic Division, Kansas City, Kansas

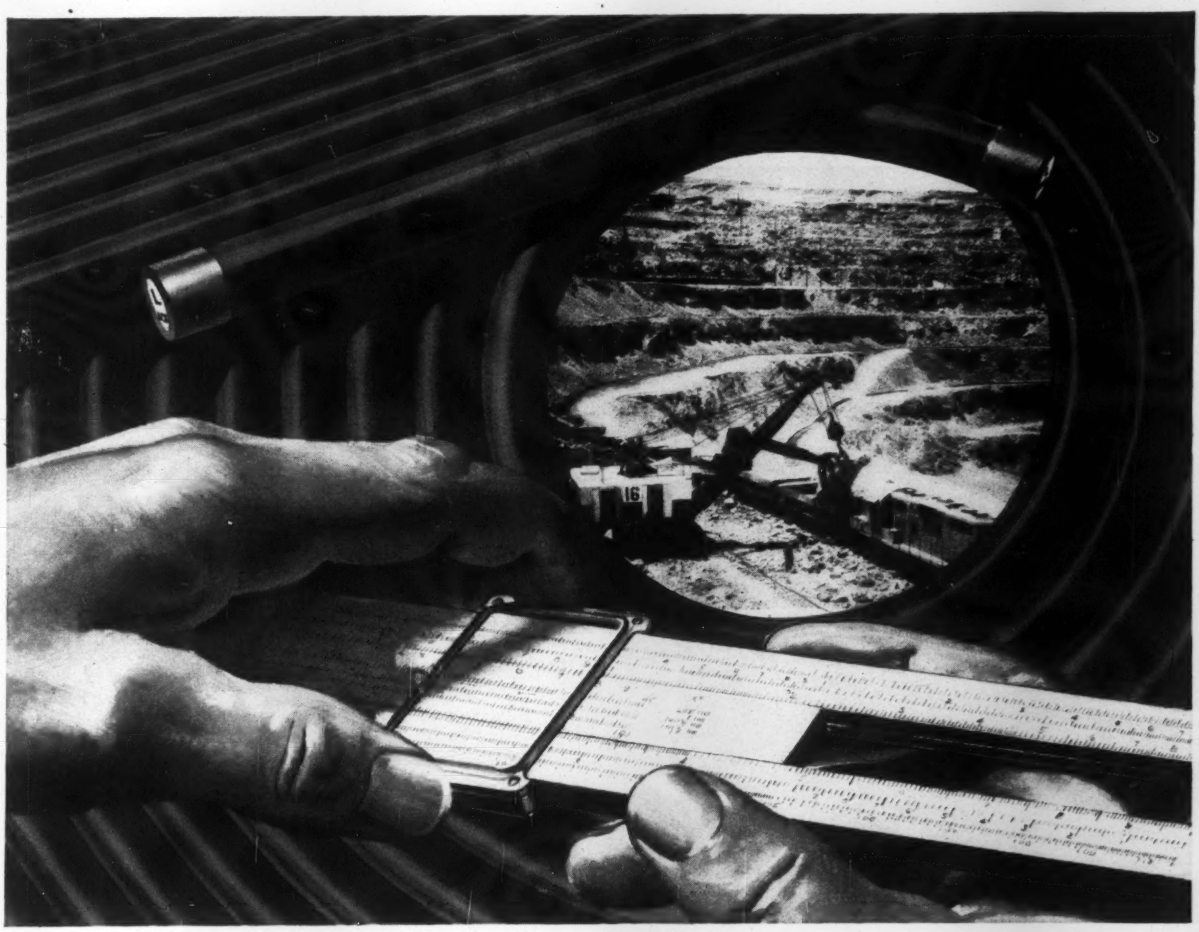
NOTE THESE DESIGN FEATURES!

- Replaceable casing wearing rings . . . for increased pump service life
- Mechanical shaft seals (or packing box)
- Sealed prelubricated bearings requiring no lubricating service
- Heavy cast-iron base, drip-lip design

Fairbanks, Morse

Pump and Hydraulic Division

A MAJOR INDUSTRIAL COMPONENT OF **FAIRBANKS WHITNEY CORPORATION**



HERE'S WHY SO MANY ENGINEERS SPECIFY

Phelps Dodge Copper Tube for refrigerating, air conditioning and heating units!

1 Phelps Dodge has complete control of its copper tube from original source to finished product. The copper used in Phelps Dodge tube comes from Phelps Dodge-owned open-pit mines, is smelted in Phelps Dodge refineries and fabricated in modern Phelps Dodge mills. This overall Mine-to-Market control is assurance of highest quality and finest workmanship.

2 Phelps Dodge devotes particular attention, throughout fabrication, to uniform anneal for tube flaring and careful control of die draw for close tolerance.

3 Phelps Dodge can supply maximum tube lengths and precise wall thicknesses engineered to customer specifications; straight length tube tempered to meet bending and expanding requirements.

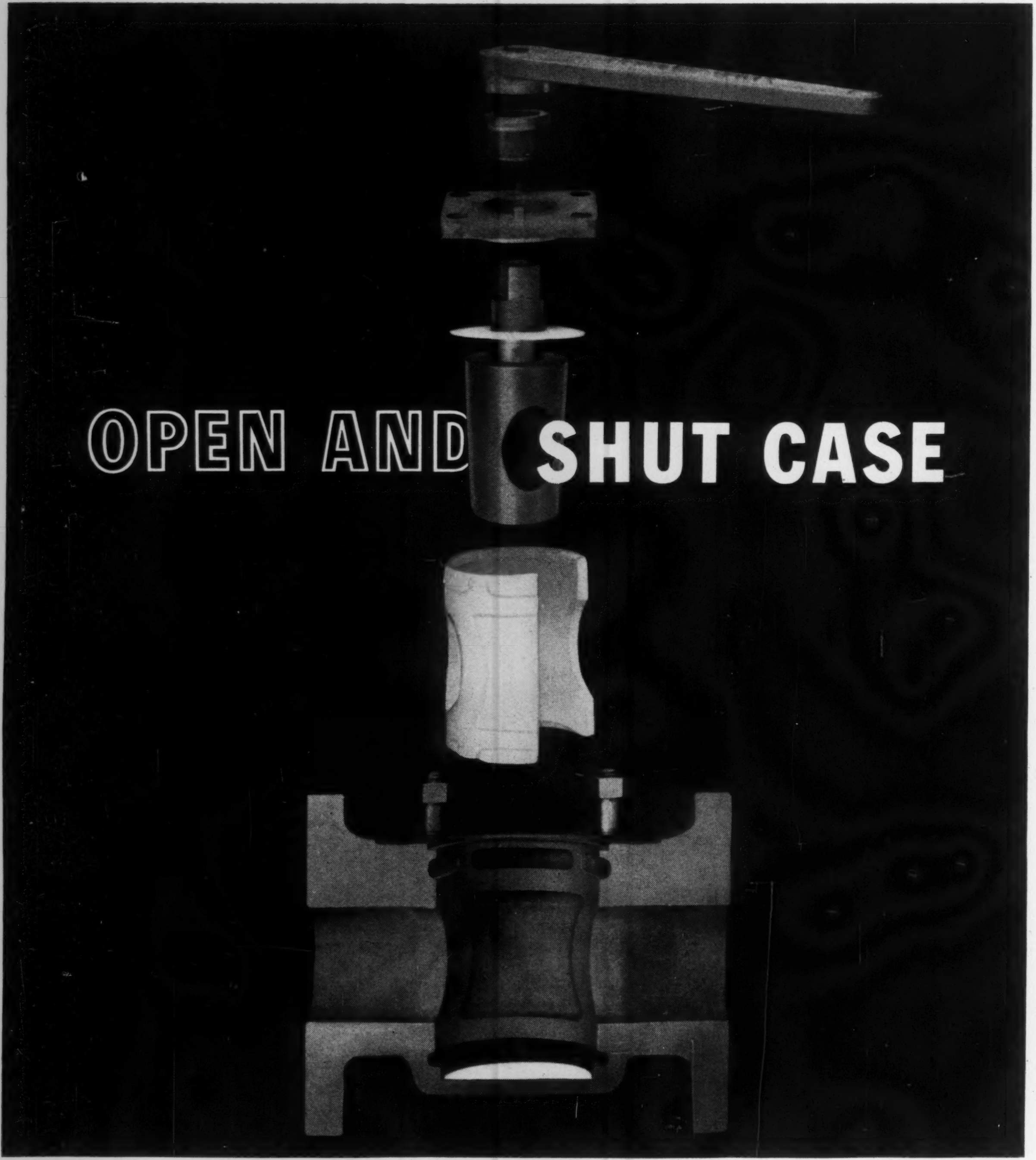
4 Phelps Dodge multiple mill operation guarantees a steady source of tube supply to meet the needs of manufacturers and distributors of refrigerating, air conditioning and heating equipment.

It's the famous Mine-to-Market Quality Line . . .
sold the quality way—through authorized wholesalers!

AIR-CONDITIONING AND REFRIGERATION WHOLESALERS
A-R-W
ASSOCIATE
MEMBER

PHELPS DODGE COPPER PRODUCTS
CORPORATION
New York, N.Y. • Los Angeles, Calif.

PD



Leakproof sealing without maintenance in ON-OFF service makes an open and shut case for specifying Continental's TUFLINE non-lubricated plug valves. ■ For the facts of the case, examine closely the special high pressure sealing ribs and carefully sculptured body bore configuration. This, combined with the specially tempered pure Teflon*sleeve and tapered plug, is where Tufline valves pay off... in bubble-tight sealing without plug adjustment even under fluctuating temperature conditions. ■ For complete information on Tufline valves ¼" through 10", 150# and 300# class, 2-way through 5-way, or jacketed, furnished in a wide range of metals for services from light hard-to-hold gases to heavy corrosive slurries, temperatures—150°F. to +400°F., high vacuum to 615 psi (depending on temperature), write Continental Mfg. Co., 230 Park Ave., N.Y. 17, N.Y. ■ *Registered trademark of E. I. Dupont de Nemours & Co., Inc.

TUFLiNE
PLUG VALVES

CONTINENTAL MANUFACTURING COMPANY · CINCINNATI 42, OHIO

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"Open for Discussion"

Notes Optimism in Air Force Operation-Maintenance Conference

THE "HPAC Engineering Data File" in the September issue reporting the Air Force Conference on Operation and Maintenance of Heating Systems is valuable in making available to the profession the experiences and conclusions of this huge, widespread enterprise. The difficulties and embarrassments occasioned because of changing personnel in the operation of these plants is a recurring theme. An illustration is cited where difficulties in operation were eliminated when a new operator was placed in charge only to have the same difficulties recur when he was replaced. This suggests a solution of placing a competent engineer, either civilian or military, in permanent charge of plants of requisite capacity on a career basis. By this means a continuity of operation and a familiarity with the installation of a particular plant would be assured. Operating and maintenance personnel training at such a plant would undoubtedly be more reliable and successful.

It is difficult to visualize the many different, and in many cases bizarre conditions under which these operations must function. The situations and requirements being as varied as there are locations on our globe, the Conference emphasis on good design, reliability of equipment, and simplicity of plan is indeed of utmost importance. These attributes are generally essential in the consideration of practically all design of steam plants but take on added importance because of the probability of frequent personnel changes.

The discussion on good maintenance in the report stresses continuous evaluation of operating records, establishing a definite maintenance policy, organizing efficient maintenance personnel, and planning and scheduling work on a definite program. Such a policy and program is paying off handsomely at the Reserve Mining Company located at Silver Bay, Minnesota, described in the July 1959 issue of HPAC titled *Planned Maintenance Pays Off In Minimum Downtime*.

The practice of taking bids for the operation of heating plants as brought out in the report seems to me to expose the Air Force to a considerable range of service from its installations. Under what conditions and when this practice is resorted to is not made clear. If awards are made on the basis of the lowest bid, this might be especially true. Safeguarding the Air Force against malpractice and low efficiency also seems to be most difficult where such a practice occurs.

There are several positive and encouraging developments in the Air Force report. That the Air Force is drawing on the experience of the other Services is good. That a steady improvement is cited in plant operation as indicated in the remarkable drop in coal consumption per boiler hp per yr from 6.4 tons in 1949 to 3.4 tons in 1958. And lastly that the Air Force has held the Heating and Power Conference to review and improve its practices.

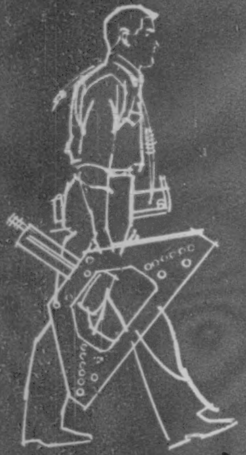
To those who have never stopped to consider the

(*Continued on page* 102)

ANNOUNCING . . . the

LIGHTEST

and most powerful 4″ segment bender on the market



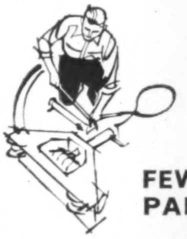
Greenlee No. 777

(1-1/4″ thru 4″)

weighs only 65 lbs.

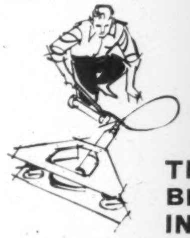
(exclusive of shoes)

COMPARE THESE IMPORTANT ADVANTAGES . . .



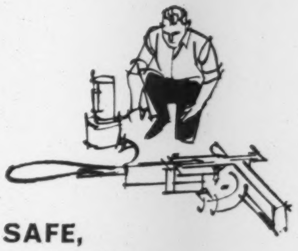
FEWER PARTS

one-piece frame of high-strength aluminum
one set of aluminum pipe supports for all pipe sizes
one set of safe, quick-locking pipe support pins.



THREE BENDERS IN ONE

a few optional parts adapt the No. 777 segment bender to fast, one-shot 90° bending 1/2″ thru 2″ and thin-wall bending 3/4″ thru 2″.



SAFE, ONE-MAN OPERATION

safety valve in pump, oil by-pass in ram, weighs only 65 lbs. excluding bending shoes.

Unmatched for over-all performance, the new Greenlee No. 777 does more jobs for you than any other bender of its type. Use it to make offsets . . . large sweeps . . . concentric bends . . . one-shot 90° bends . . . thin-wall bends.

Its 27-ton ram has power to spare for segment bending of steel or aluminum conduit and pipe 1-1/4″ thru 4″ — will bend extra heavy schedule 80 pipe. Comes equipped with a hand hydraulic pump, but can be operated with power pump for even faster performance.

OPTIONAL EQUIPMENT FOR ONE-SHOT AND THIN-WALL BENDING

One shot 90° bending 1/2″ thru 2″

90° bends in one shot An important *exclusive* advantage you get with this new, lightweight GREENLEE segment bender. Simply by adding bending shoes and adapter, you can make any bend up to 90° in 1/2″ thru 2″ conduit or pipe in *one shot!*

Thin-wall bending 3/4″ thru 2″

Quickly mounted thin-wall attachment The No. 777 segment bender can be quickly and economically converted to bend thin-wall conduit 3/4″ thru 2″. Standard No. 770 thin-wall attachments fit the No. 777 bender with only the addition of one roller.

ASK YOUR DISTRIBUTOR FOR A DEMONSTRATION NOW! Write for bulletin E-249

GREENLEE TOOL CO., 1937 Columbia Ave., Rockford, Illinois

TOOLS FOR CRAFTSMEN
GREENLEE JOB-PROFIT TOOLING
. . . cost control for contractors

"Open for Discussion"

Continued

magnitude of the heating and power plant installation for which the Air Force and other branches of the armed services are responsible, the report is indeed a revelation. With the diversity of conditions imposed on these operations our profession can profit greatly by reviewing the success and lack of success in the experiences of the Air Force in this field.

LESTER RIES
Consulting Engineer

Warm Air Travel Across Large Space Depends on Volume, Not Pressure

IN your "Open for Discussion" section in the August HPAC, I noticed a question by H. P. Kaulfuss, asking some questions about the article *Ultra-Modern Engine Plant Demands Unique Heating, Ventilating Systems* (May), by Lester S. Ries and the answer. Mr. Ries, in my opinion, fails to answer one of the questions and perhaps he would like to have the answer from me.

The question is "Also blowing heated air a distance of 100 ft to an unheated west wall and maintaining a sufficient blanket of warm air at this point seems incredible; please elaborate on this feature." Perfectly good results can be obtained from distances considerably greater than 100 ft on either a recirculating system or a ventilating air makeup system where exhaust fans are in operation. Note that either the exhaust fans or the return air in a circulating system are apt to be near the floor. Driving the warm air into the room at the 10 ft level with a smooth ceiling, or a ceiling higher than 10 ft, the tendency of the air will be to travel close to the ceiling, rising to the ceiling if higher.

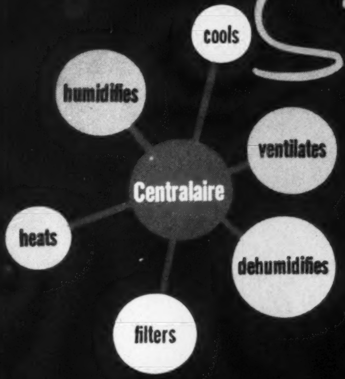
It is incorrect, however, to use the term "throw". The air will do the same thing, perform in the same way, if it is just simply "dumped" into the room. The simple reason is that no matter how much pressure you put behind the so-called "throw", if that pressure had to push the incoming air through the body of air, the force of the "throw" would soon be lost, but such is not the case. The exhaust, or return air opening, will take air off lower down. There is therefore a tendency for the air within the room to settle toward the level of the exhaust and when heated air is put into the room at any point there will be two characteristics noticed. One — it will rise to the highest point in the room because it is warmer and lighter and the heavier air seeks the lower level. Two — if pointed in any given direction by the outlet, it will travel in the same direction until it strikes an obstruction; not because it is thrown, but because there is more heated air coming in right behind it and pushing it on. If pointed toward the outside wall across the room, it will travel across until it hits that wall or it will travel until it loses its temperature and begins to fall.

The question of getting the warm air to the wall across the room, regardless of distance, is one of handling the proper volume of air in proportion to the size of the space. The volume of air handled must be sufficient not only to travel across the room, but so that it can turn down when it strikes an obstruction and reach the floor while it is still warm. A good "rule of thumb" is that a volume of air equal to the cubic contents of the room must be handled every 10 minutes. If this is done, warm air will travel across the room, heating the opposite wall and turn down that wall, and a thermometer hung there will register a temperature about 1 F warmer than a thermometer hung on the wall beside the outlet.

This results in perfect blanketing of the opposite wall. I have tested it and applied it at a great many churches where people are very susceptible to drafts, but they don't get a draft even from a big leaded glass window. We took the responsibility in 1927 of heating the Butler University Field House in Indianapolis in which the basketball court and gymnasium was 332½ ft long, 206 ft wide and 90 ft high in the center. The air was brought in by one vertical shaft, rising from the furnaces below, discharged 50 ft above the floor, about 10 ft above the highest bleacher seats and the return air was taken out immediately below beside the rising shaft. In an exhaustive thermometer test, with thermometers all over the place and at different levels, the greatest variation in temperature on any given level was 3 F. The temperature gradient between the highest and lowest thermometer, a distance of 83 ft, was only 12 F. This was only guaranteed to heat the building to 60 F in zero weather. It was 5 F below zero when the tests started, 5 F above when it was finished. The temperature of 60 F, 6 in. above the floor was gained, with 72 F at the top. It was 208 ft from the outlet across the building and approximately 250 ft to the farthest corner. The air was not delivered at high velocity. It was not "thrown". It was just pushed in and it floated.

We applied the same ideas in a modification building at Offutt Air Field, Ft. Crook, Nebraska, the nearest wall to the outlet being 208 ft away. Such results within any room can be accomplished by using the proper volume of air. In the Butler University Field House, the temperature rise of the air passing over the furnaces averaged about 25 F. It is volume that does it.

E. K. CAMPBELL
E. K. Campbell Co.

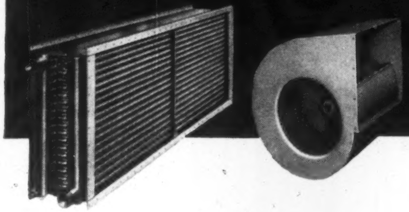


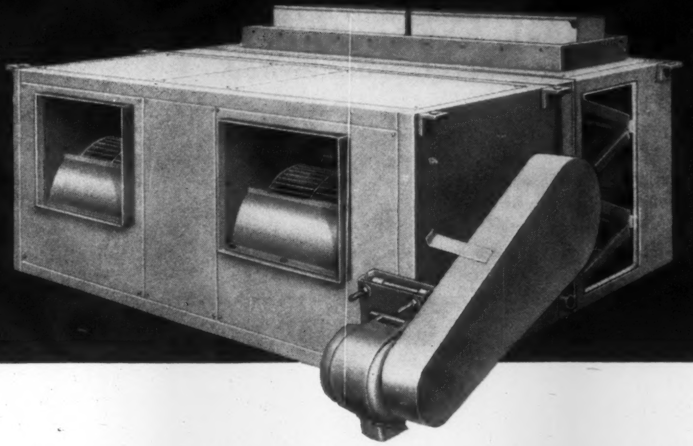
Sectionalized Design

enables one unit to perform up to six different air handling jobs!

AIRTHERM
CENTRALAIRE

CHOICE OF FAN & COIL SIZES
By using one of two different fan sizes, Centralaires can operate at or near top efficiency regardless of system static pressure and air volume needs. Three coil face area sizes—from which one is selected—enables the coil face velocity to meet design conditions and match the fan.





GRAPHIC SELECTION METHOD FEATURED IN NEW BULLETIN!

Contains an amazingly simple graphic selection method for fast, easy sizing. Gives the complete story on Centralaire units. Write for Bulletin No. 404 today!

Versatility that's practically unlimited! Sectionalized design permits *one* unit to meet *both* the space and air handling requirements of any commercial building needing 400 to 30,000 CFM output. Noise has been reduced to a lullaby level.

Utilizing steam or hot water, chilled water or refrigerant, this central station air handling unit performs all the functions of good air conditioning—heating, ventilating, cooling, dehumidifying, humidifying, and filtering, depending on specifications.

Cabinets are handsomely finished in mar-resistant metallic bronze . . . flush-mounted enclosure panels provide a trim, clean appearance.

See your Airtherm Representative for more information!

AIRTHERM MANUFACTURING COMPANY
P. O. Box 7039 • St. Louis 77, Mo.

For steam, hot water, chilled water systems

CABINET UNIT HEATERS • CABINET AIR CONDITIONING UNITS • VERTICAL & HORIZONTAL UNIT HEATERS • CONVECTORS

question of the month

"How Can We Protect Boilers' Internal Metal Surfaces?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with an answer that has been received from a reader. Other solutions or comments for publication are invited.

> *"A problem we have been encountering is the deterioration of the internal metal surfaces of our steam and hot water boilers, as well as some heat exchangers. This condition seems to get worse with higher temperatures.*
>
> *Are there any compounds or surface coatings available which retard or prevent this deterioration? If so, how are they applied? What are their compositions? What temperature and pressure limitations should be considered in their application?*
>
> *Any information others can offer will be greatly appreciated." — P.D.W.*

Effective Boiler Corrosion Prevention Starts Before Corrosive Action Begins

A VERY LARGE proportion of all water side corrosion is due to free oxygen or carbon dioxide or both in the boiler water. Therefore, it is of primary importance to use every practical means to keep these gases out of the boiler. Good maintenance of the boiler from this standpoint begins with the design of the heating system.

To minimize the frequency of washing the water side, and to help control water side corrosion, it is necessary to design so that little or no fresh water will be needed in a steam system. Also, the condensate return must be arranged so that any oxygen or carbon dioxide which is entrained will be vented before the water is returned to the boiler.

Also, one or both of these gases will enter whenever fresh water is added in a steam system. Either or both may be drawn into the return lines and enter the boiler with the condensate. For these reasons, the amount of makeup water must be kept at an absolute minimum and the air eliminators in vacuum return systems must be kept in good operating condition.

A low water cut-off is frequently used in water boilers, chiefly to prevent the burner from starting when the system is empty.

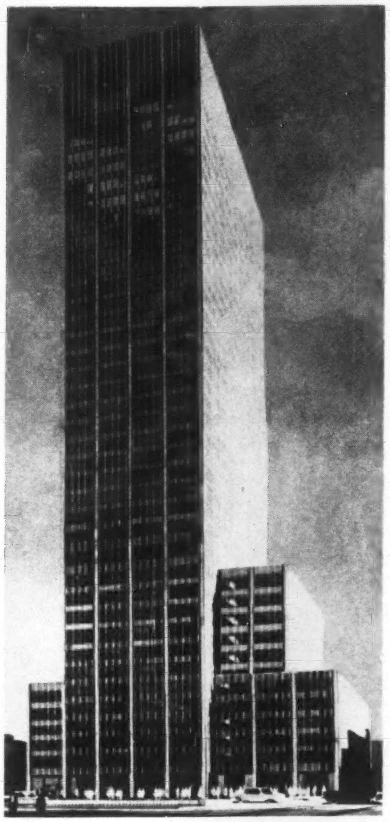
In addition to this device, many designers specify the use of water feeders on steam boilers. These units introduce water automatically when the water line drops to the level at which it is set. They are desirable on stoker fired boilers, and some designers use them on oil or gas fired boilers also.

From a standpoint of boiler corrosion, it is extremely important to locate a water feeder so it will maintain water at the lowest safe level and never at the normal operating level. A boiler feeder should be considered as emergency equipment and never as operating equipment.

If the boiler loses water for any reason such as, for example, an undetected leak in a return line, the water line will drop and the low water cut-off will stop the oil or gas burner before any damage is done.

If this happens frequently, the operator will be warned of the leak and will take steps to locate and correct it. However, if a water feeder is set to maintain the water level above the low water cut-off level, then a leak may be undetected, because the feeder at that location is intended to keep the boiler in operation. Thus, there may be no evidence of loss of boiler water until the oxygen which enters with the feed water has destroyed the boiler tubes or until there is serious boiler scale or both.

(*Continued on page* 106)



The First National City Bank Building, New York City

FROM COAST TO COAST — PROVED SUPERIOR, ON THE JOB, IN TODAY'S MODERN STRUCTURES

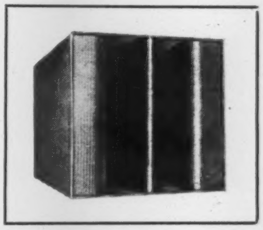
UNI-SILENCER*

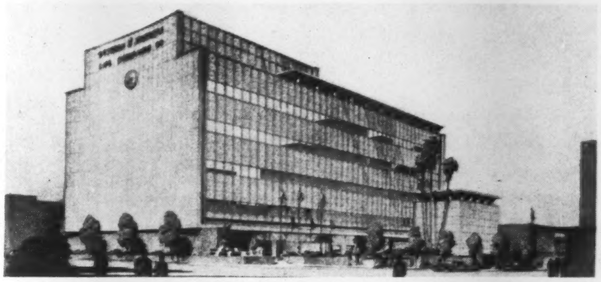
All over the country, leading mechanical engineers and contractors are specifying Uni-Silencers to meet the increasingly complex demands for sound control of air conditioning and ventilating systems. Their advanced acoustical properties were a major development of the research laboratories of Elof Hansson, Inc., an international organization with world-wide resources. Their *certified* performance is *guaranteed in writing to you,* and bonded.

A COMPLETE LINE FOR EVERY PURPOSE

Uni-Silencers, made in sensible, small, manageable units, are slip-joined, like children's building blocks, making for simple installation to fit almost any structural requirement. There is a range of 7 models to reduce effectively the air-borne noise generated by fans in air conditioning and ventilating systems and by power roof ventilators. Special units are engineered for unusual job conditions.

Because of new mass production methods based on standard, modular sizes, and ease and economy of installation, Uni-Silencers effect important savings — a precision method at a cost comparable to conventional duct lining.





The Western & Southern Life Insurance Company Building, Los Angeles

Send for Free Uni-Silencer Selection Chart

No more guesswork in selecting the right type of silencer for *your* particular problem of noise control. This valuable engineering tool gives accurate directions, with examples of efficiencies, explanatory graphs, and Noise Criteria for Rooms, with recommended NC curves. Write for your free copy today.

ELOF HANSSON, INC.

Acoustical Division
711 THIRD AVENUE, NEW YORK 17, N.Y.

*Reg. U. S. Pat. Off.

AUTHORIZED SALES REPRESENTATIVES IN EVERY MAJOR CITY IN THE U.S. AND CANADA

ALBUQUERQUE, NEW MEXICO
Air Equipment Co.
ATLANTA, GA.
Southern Acoustics & Supply
BALTIMORE, MD.
Lancaster, May & Co.
BEVERLY HILLS, CALIF.
Ralph E. Bennett & Associates
BIRMINGHAM, ALA.
Havco Sales Co.
BOISE, IDAHO
Paul E. Benton Company
BOSTON, MASS.
Leonard F. Luchner, Inc.
CALGARY, ALBERTA
H. F. Clarke Limited
CHARLESTON, W. VA.
McGee-Feher Co.
The Ben Scory Co.
The Pedley Equipment Co.
CHARLOTTE, N.C.
Chet Adams Co.
CHICAGO, ILLINOIS
Anning - Johnson Co., Inc.
CHATTANOOGA, TENN.
H. M. Sawrie & Co.
CLEVELAND, OHIO
Minor-Webber, Inc.
DALLAS, TEXAS
The Dunne Co., Inc.
DENVER, COLO.
Herman & Von Rosenberg
DETROIT, MICH.
The Nichols Co.
EAST ORANGE, N.J.
Woolsulate Corp.
FLORISSANT, MISSOURI
AP Equipment Co.
FRESNO, CALIFORNIA
G. J. Yamas Co., Inc.
GREENSBORO, N.C.
Chet Adams Co.
HARTFORD, CONN.
Alfred J. Hamilton Co.
HOUSTON, TEXAS
The Dunne Co., Inc.
INDIANAPOLIS, IND.
Colby Equipment Company
JACKSONVILLE, FLA.
Southern Acoustics & Supply
KANSAS CITY, MISSOURI
D. M. Allen Co.
LAS VEGAS, NEVADA
G. J. Yamas Co., Inc.
LOS ANGELES, CALIFORNIA
Preferred Equipment Co.
LOUISVILLE, KENTUCKY
Phil L. Riley Co.
A P Equipment Co.
LUBBOCK, TEXAS
The Dunne Co., Inc.
MASPETH, L.I.
Noise Reduction Products, Inc.
MECHANICSBURG, PA.
Heath-Crowley Co.
MELROSE PARK, ILL.
Anning-Johnson Co., Inc.
METAIRE, LA.
A. G. Kirkwood Co.
MILWAUKEE, WIS.
Air Handling & Specialty Co.
MINNEAPOLIS, MINN.
Jay Distributing Co.
MONTREAL, CANADA
Air Conditioning Engineering Co. (Canada) Ltd.
Masdom Corporation Ltd.
NORFOLK, VA.
Chet Adams Co.
NORMANDY, MO.
A P Equipment Co.
NORTH FORT WORTH, TEX.
The Dunne Co., Inc.
OKLAHOMA CITY, OKLA.
Harold C. Parker Co., Inc.
OMAHA, NEBR.
Central States Engineering & Sales
PHILADELPHIA, PA.
Harry Mather, Inc.
PHOENIX, ARIZONA
Arizona Acoustics
PITTSBURGH, PA.
McGee-Feher Co.
PORTLAND, OREGON
Mead and Associates
RALEIGH, N.C.
Chet Adams Co.
RENO, NEVADA
G. J. Yamas Co., Inc.
ROCKFORD, ILLINOIS
Acoustical Engineering Co.
RICHMOND, VA.
Chet Adams Co.
SACRAMENTO, CALIF.
G. J. Yamas Co., Inc.
SALT LAKE CITY, UTAH
Paul E. Benton Company
SAN ANTONIO, TEXAS
The Dunne Co., Inc.
SAN FRANCISCO, CALIF.
G. J. Yamas Co., Inc.
SEATTLE, WASH.
George E. Mead Company
SHREVEPORT, LA.
Southern Acoustics & Supply
SILVER SPRINGS, MD.
Lancaster, May & Co.
SOUTH PORTLAND, MAINE
A. E. Wallgren
ST. LOUIS, MO.
A P Equipment Co.
SPOKANE, WASHINGTON
Climate Control Co.
SYRACUSE, NEW YORK
Lewis Reid
TOLEDO, OHIO
Air Handling Products Co.
TORONTO, CANADA
Masdom Corporation Ltd.
VANCOUVER, B.C.
H. F. Clarke (B.C.) Ltd.
WICHITA, KANSAS
D. M. Allen Co.

question of the month

Continued

Open or vented condensate receivers are commonly used in multiple system steam boiler installations. Receivers should be large enough to hold any slugs of condensate without overflowing and should be open or well vented to release any gases which may have been introduced with the returns.

From the standpoint of boiler corrosion, a water feeder should not be used in a condensate receiver. At this location, the feeder will always operate to keep water in the receiver and so maintain a normal water line. Feeders, if used, should be installed in each boiler and should be located to maintain the water line at a minimum safe level and not at the operating level.

Since it is not practical to eliminate oxygen entirely, the water in each steam heating boiler should be treated with a suitable corrosion inhibitor. To permit easy feeding of the inhibitor, a suitable compound feeder is desirable in each steam heating system. This is a simple device, frequently made up from pipe fittings and usually located in the condensate return line.

In a steam heating system where all or nearly all the condensate is returned to the boiler, the inhibitor may be the one shot type, where a single treatment will be effective for the entire time between wash-out periods. Such an inhibitor doesn't vaporize and so it remains at full strength unless water is lost from the boiler or return lines.

In large installations it is usually advisable to have an experienced boiler water company to supervise the water treatments.

The Steel Boiler Institute boiler water treatment is a good corrosion inhibitor. In steam boilers, it is used at a concentration of about 2200 parts per million. This corresponds to about 2 lb per 100 gal of boiler water.

This compound has been used with satisfactory results for many years and has been extensively tested in a series of accelerated corrosion tests conducted by one manufacturer and extending over a period of about 5 yrs. These tests have shown that the compounds, when maintained at proper concentration, will prevent oxygen corrosion in new boilers and will also arrest corrosion after it has started.

This boiler water treatment is specifically a corrosion inhibitor. It will not be suitable as a wash-out compound and it does not prevent scale. It is intended for use in normal tight steam heating systems where all or practically all of the condensate is returned to the boiler and where little or no makeup water is required for regular operation.

Of course I am not recommending that a water treatment being presently used with good results be abandoned in favor of this one.

Treated boiler water should be tested periodically and more compound added if necessary to keep the treatment up to proper strength. If you are now using a water treatment, probably the necessary materials and testing instructions have been supplied by the company which supplies the treatment.

If the Steel Boiler Institute compound is used, tests may be made by using one of the colorimetric test papers which are available in convenient dispensers. Boiler water may be tested a day after the first treatment and the color of the test paper noted. Further tests at weekly intervals or as required will insure that treatment is maintained at proper strength as indicated by the same test paper color.

Careful attention at the time a new boiler is put in service will pay big dividends by decreasing the probability of future corrosion trouble. The boiler should not be filled with water and allowed to stand, but rather fired immediately after being filled with raw water. This is necessary to prevent the start of water side corrosion.

Water fresh out of the mains always carries dissolved oxygen and CO_2. Either or both of these gases attack the boiler heating surfaces and may result in substantial corrosion unless driven off by boiling the water or heating nearly to the boiling point. This fact has been proved many times by corrosion of the boilers in the field and has also been proved in the laboratory.

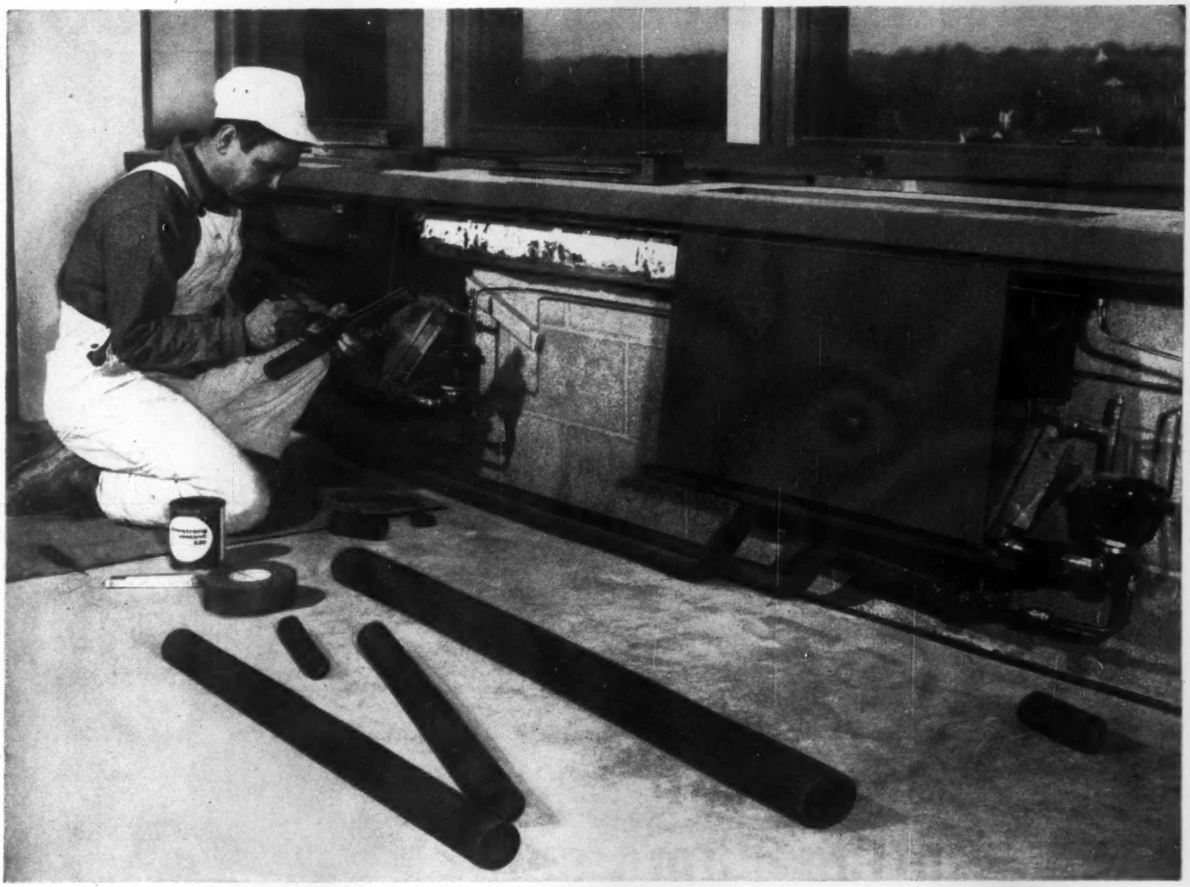
It is desirable to complete the boil-out or first internal cleaning at the time when the boiler is first filled and fired. This work should be done before the heating plant is turned over to the owner by the contractor and in any event before the heating system is put in service.

The water line in a steam boiler should be checked visually at least once a day and oftener if it shows signs of being erratic. If the boiler loses water at a rate greater than 1 gage per month, there is reason to suspect leaks in the system. Any leaks in either the steam or return lines should be located and corrected at once.

The appearance of rust in the water glass is usually an indication of corrosion and the strength of the boiler water treatment should be checked at once. Then treatment should be brought up to strength, if necessary.

Evidence of continuous development of rust in the heating boiler system is a danger signal which should not be disregarded. Drain and wash the boiler and inspect for signs of corrosion, and if any are found, take whatever steps are indicated to correct it. If the boiler is free of corrosion, then try to locate areas

(Continued on page 223)



Here's one cold line that will not sweat

Condensation on cold lines can be stopped—surely and economically—with Armstrong Armaflex 22 Pipe Covering. New improved Armaflex 22 is a flexible foamed plastic insulation with better vapor resistance, durability, and appearance—plus a wider temperature range than other insulations of this type.

New Armaflex 22 offers complete protection against water and water vapor. Applied in recommended thicknesses to any cold lines, it stops damaging condensation. No finish is needed on indoor installations. And you can be proud of the appearance of a job done with Armaflex 22. A new, super-smooth surface gives you a neater installation.

Armaflex 22 can be applied not only to all cold lines, but also to heated piping operating to 220° F. That means that on jobs where hot water, chilled water, refrigeration, and dual temperature lines are involved, this one insulation can be used throughout to simplify the installations.

The only tools needed to apply Armaflex 22 are a miter box, knife, brush, and can of Armstrong 520 Adhesive.

Complete information on Armaflex 22, explaining in detail why it is a superior insulation of its type, is contained in a new booklet. Write for your free copy today to Armstrong Cork Co., 2211 Sherman St., Lancaster, Pa.

Armstrong INSULATIONS

1860-1960 Beginning our second century of progress

It's a NASH Heating Pump, PLUS!

The type CSI NASH Heating Pump sets a new standard of economy

Now a Nash quality Vacuum Heating Pump can be economically installed and operated on any steam heating job. Engineered for high performance and low installed first cost, this new pump still makes use of time tested Nash principles of operation.

The Nash CSI has generous air capacity and features a wide choice of water capacities and discharge pressures. The right combination of capacities is at hand to match the requirements of the job. It is no longer necessary to pay extra for a pump with excessive water capacity, excessive discharge pressure, or in an attempt to get adequate air capacity.

With this advanced design, Architects, Engineers and Contractors will find answers to many heating system problems. Send for bulletin now.

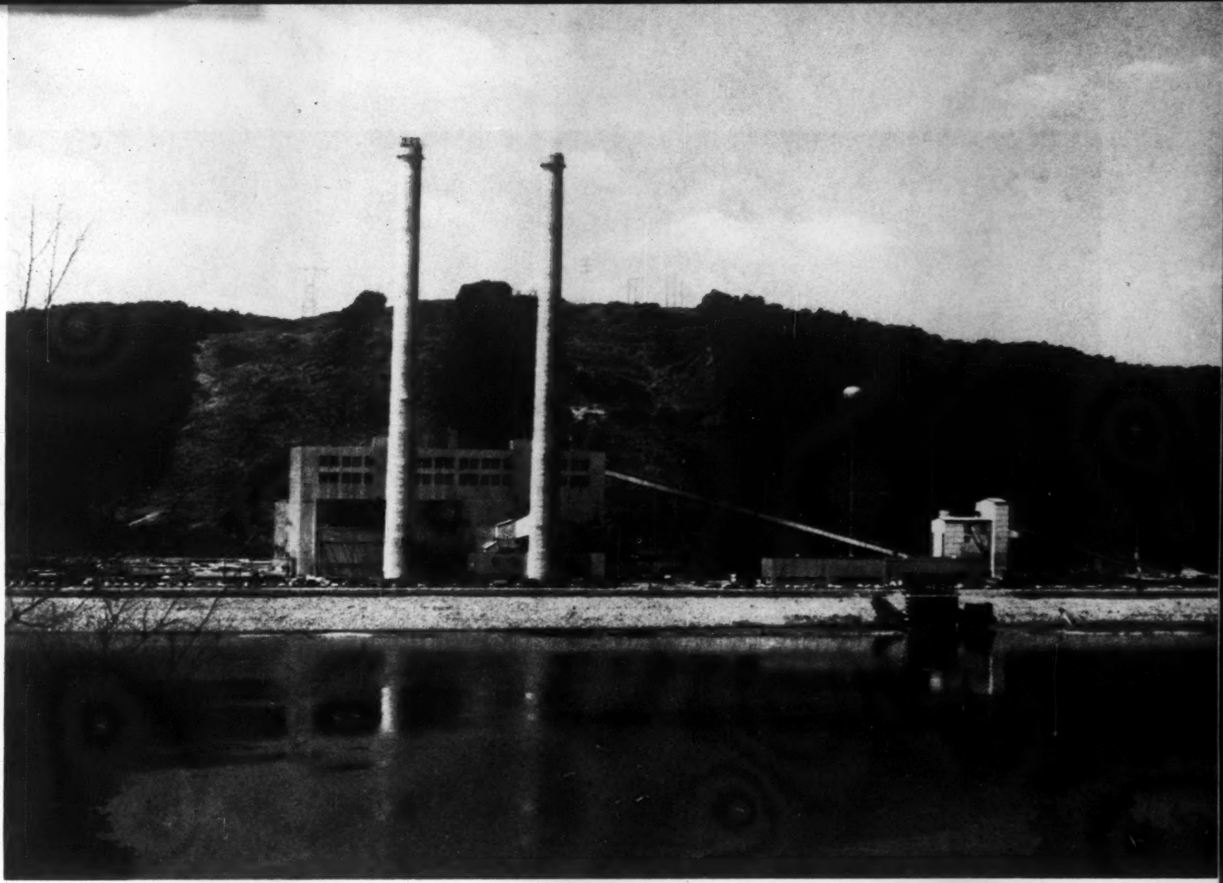
1 ECONOMY IN FIRST COST

2 ECONOMY OF INSTALLATION

3 ECONOMY OF OPERATION

4 ECONOMY OF MAINTENANCE

NASH ENGINEERING COMPANY
449 WILSON, SO. NORWALK, CONN.



At Stratton Station Electric Generating Plant . . .

One Design Serves Four Times On Power Piping Job

By A. W. SEVERANCE
Mechanical Design Engineer
Commonwealth Associates Inc., and
W. C. SHEPHERD
Production Engineer
Ohio Edison Co.

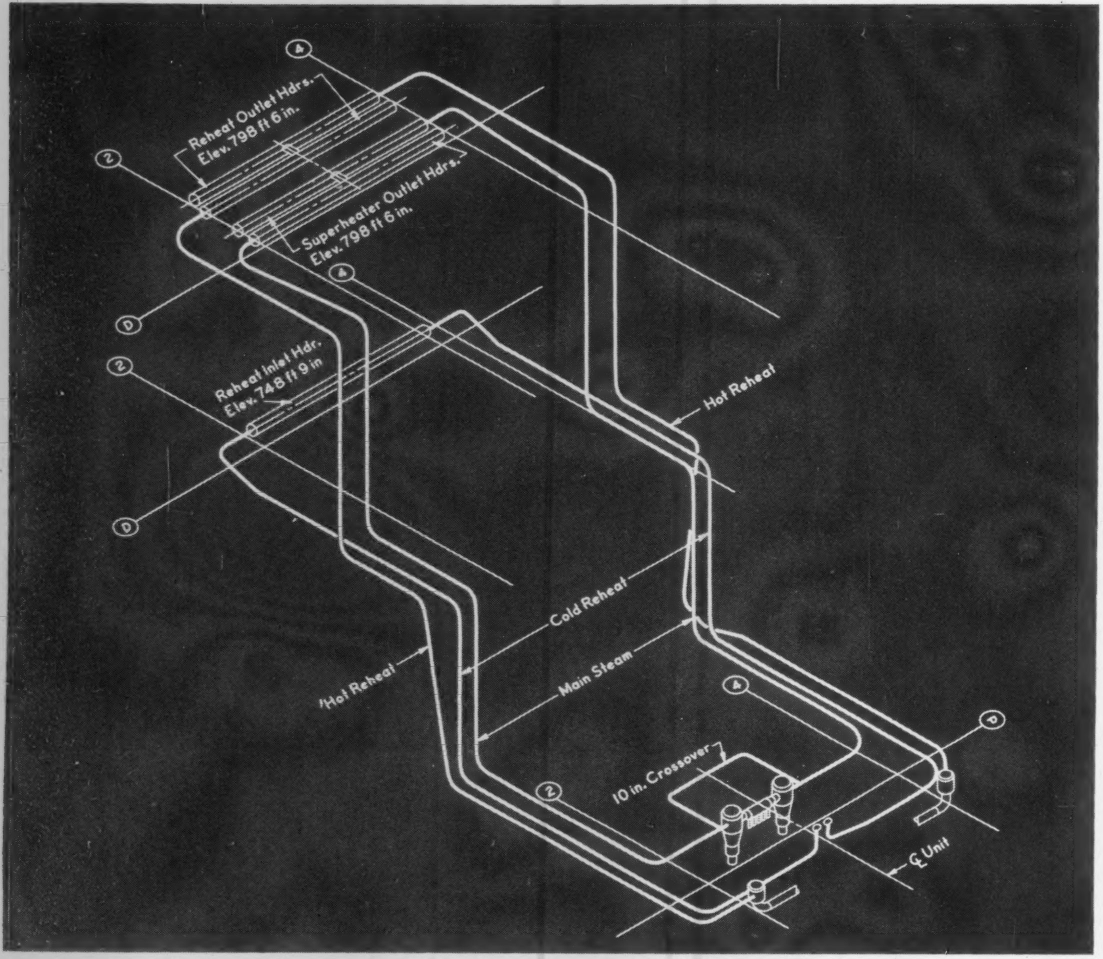
THE original plant concept for the new Ohio Edison Co. electric generating station at Stratton, Ohio, involved the placing of coal bunkers in the center of the station between steam generators and turbines, plus the installation of all main steam piping and reheat piping in double parallel lines, and thus posed some interesting problems for piping designers.

Present plans are for the completion of the entire four-unit generating plant by the summer of 1962. All four turbine generators are 3600 rpm, tandem-compound, triple flow, condensing type rated at 185,000 kw gross, coupled to steam generators of the single reheat type.

The first unit was placed in commercial operation in August of 1959, followed by the second in July of this year. The third and fourth are to follow at one year intervals.

The design of the generating system was prepared by Commonwealth Associates Inc. of Jackson, Mich.

From a boiler capacity of 1¼ million lb of steam per hr, with a boiler drum pressure of 2570 psi



1 MAIN STEAM and reheat piping for Stratton Station electric generating plant is routed in double parallel lines on three levels. 10 in. crossover line at turbine end balances temperature and pressure variations

and superheater outlet pressure of 2450 psi at 1050 F, turbine throttle pressures of 2400 psi are attained. Reheat outlet temperature for the system is 1000 F. Fig. 1 shows in isometric form the routing of the piping system as finally determined. The 10 in. main steam crossover pipe installed between the main steam lines at the turbine end was so placed to balance any steam pressure and temperature variations. A parallel line installation design was predicated on the use of "Siamese" type reheat and superheat outlet headers to maintain even temperature distribution.

Determine Main Steam Pipe Size

The main steam pressure drop from the superheater outlet to the turbine was arbitrarily established at 50 psi. For this condition, a pipe size of 14 in. OD with a 2.637 in. minimum wall thickness was established, which would allow a full 10 percent for thinning due to bending.

At this point in the design work, preliminary calculations showed that the stresses to be encountered approximated the maximum allowed by the Ohio State code. Forces and moments at the turbines, however, exceeded those allowed by the equipment manufacturer.

Rigorous analysis as programmed for a digital computer indicated that the placement of added restraints in the runs would bring these stresses within allowable limits. The exact location of the restraints varied between the first two units and Nos. 3 and 4, due to the fact that the turbines were manufactured by two different firms and configuration differed.

Operation Confirms Analysis

Since the start up of the first unit, actual field measurements have been made of the main steam pipe movements. These measurements show movements to be less than anticipated, which can be ac-

• **Power piping design for Ohio Edison Co.'s electric generating station at Stratton, Ohio has been accomplished on a "four-for-one" basis. Four boiler-turbine generating units are being installed successively over a four year period. Since the units are identical, the double-parallel main steam and reheat piping layout design for the first unit applies to the second, third, and fourth as well. Further economies are possible from the experience gained while completing the first and second units, now in operation. Certain design considerations, choice of materials and pipe sizing, methods of stress relieving, and final cleaning of the system are described in the text.**

Mr. Severance has served his present firm for 20 years, after extensive work with industrial companies, and holds the position of mechanical design engineer. He is a graduate of Tri-State College, and a registered mechanical engineer in Michigan and several other states.

Mr. Shepherd is a graduate of the University of Akron, has served as mechanical design engineer for industrial, public utility, and U. S. Government organizations before assuming his present position with Ohio Edison Co. He is a registered engineer in Ohio.

counted for principally by the less than rigid terminals at the superheater outlet header.

The reheat piping from the boiler to the turbine (called the hot reheat piping) was routed essentially the same as the main steam line as shown in Fig. 1.

A 7 F temperature drop between the boiler outlet and the turbine was arbitrarily selected to be small for optimum plant performance. The established reheat safety valve setting of 545 psi was used to arrive at the selection of an 18 in. OD pipe with the minimum wall thickness of 0.679 in.

Select Material by ASTM Specs

The material selected for the main steam line was in accordance with ASTM Specification A-335-P22

INSTALLATION of main steam and reheat piping diagrammed in Fig. 1 is pictured above. Design called for piping up to 18 in. in diameter, with up to 3 in. thick walls

— a $2\frac{1}{4}$ percent chrome, 1 percent molybdenum steel. About 547 ft of main steam piping is required for each unit.

ASTM A-335-P11, a $1\frac{1}{4}$ percent chrome, 0.5 percent molybdenum steel, is used for the hot reheat piping, to accommodate temperatures of 1000 F. Here each unit requires about 557 ft. 450 ft of grade B, schedule 40 (ASTM A-106) pipe is used on each unit for the cold reheat lines.

All pipe was inspected at the factory for chemical and physical characteristics by an independent inspection agency. Following shipment to the fabricating shop, and later at the plant site, the pipe was ultrasonically tested for unseen flaws. As expected, none were uncovered.

On Units 3 and 4, the construction schedule is such that pipe of the hollow forge type can be utilized.

Weld with Backing Rings

All steam and boiler feed piping field welds were made employing the use of backing rings and were given gamma-ray inspection. This inspection was accomplished directly for the owner by two separate firms for units 1 and 2.

In the course of the inspections, it was found that external radiation photographs could be made satisfactorily through two walls, permitting the elimination of the insertion holes near the welds. Even though wall thicknesses of $2\frac{3}{4}$ to 3 in. were involved, such an inspection procedure was found to be desirable from both the economic and schedule-meeting standpoints.

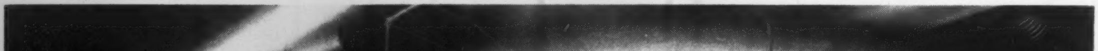
Feed Piping Sized for Economy

Boiler feed piping from the feed pump discharge to the boiler economizer inlet, the layout of which is shown in Fig. 2, is designed for operation at 3250 psi and 525 F. A $12\frac{3}{4}$ in. OD pipe size was established, with 1.224 in. wall thickness, plus additional lengths of $10\frac{3}{4}$ in. OD schedule 160.

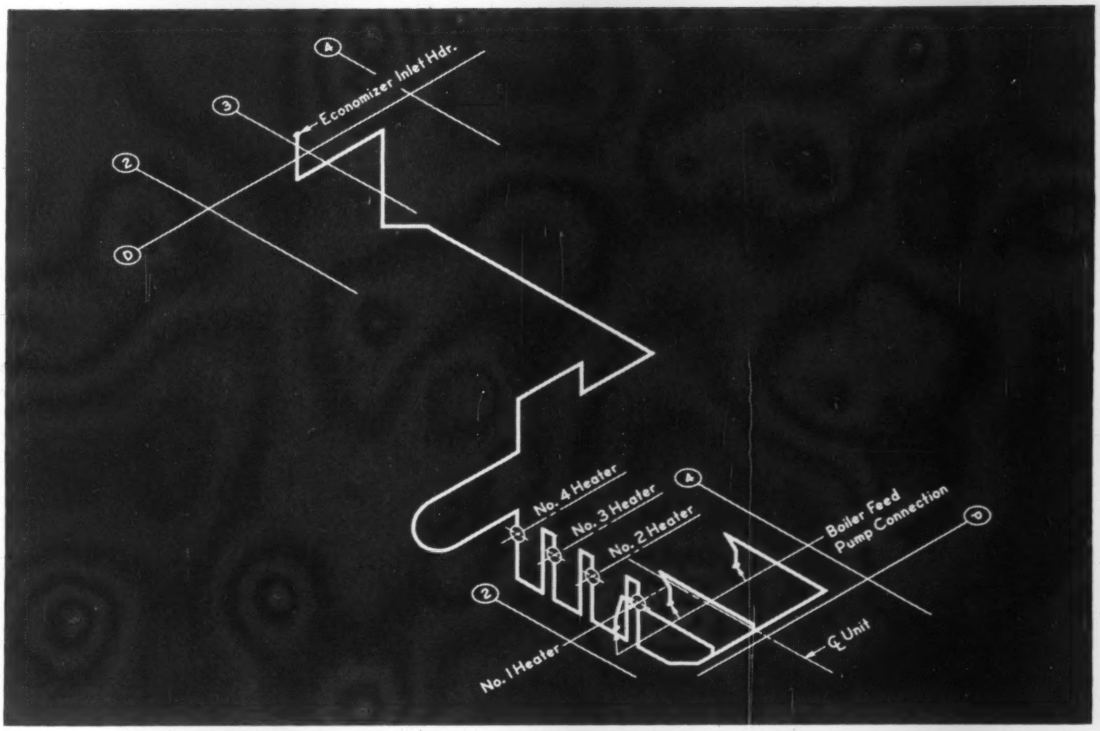
This sizing was made possible through the use of ASTM A-106, grade C piping which permitted an allowable stress of 17,500 psi instead of the 15,000 psi maximum allowable for grade B. The use of grade C piping resulted in substantial savings in cost for this installation.

Clean Steam Lines With Steam

Blowing out with live steam to the atmosphere accomplished the cleaning of steam lines. First, the main steam line was cleaned by means of temporary piping connected between the turbine throttle valve to the outside. Then, by changing the location of the temporary piping, the low temperature reheat lines were cleaned, after which further changes in the temporary rigging allowed us to clean the reheater



VIEW of mezzanine, or second, level shows main and reheat steam piping, plus feedwater heaters and feedwater piping



2 BOILER FEED piping, from feed pump discharge to boiler economizer inlet, is designed for 3250 psi and 525 F

and high temperature reheat lines. Maximum blowout pressure used during the operation was 600 psi.

Wash Heaters and Feed Lines

Demineralized water was used to wash the high pressure heaters and boiler feed piping for units 1 and 2. The water was admitted through the dismantled check valve at the boiler feed pump outlet, passed through the system and was removed at the stop valve bonnet on the discharge side of the fourth high pressure heater.

The same operation will be accomplished on units 3 and 4 by omitting one elbow on the boiler feed pump discharge until after washing has been accomplished. The system will then be closed by installing that fitting. A tee will be placed in the line beyond the fourth high pressure heater for use as a wash water drain connection, and after washing this will be closed with a welded cap.

Design Provides Economies

The purchase of the four identical steam generating units has permitted the use of a single basic piping design suitable for all four sections. Such a plan has, of course, resulted in substantial economies during both design and installation stages. Furthermore, because the units are being installed in successive steps, the experience gained during work on unit No. 1 has pointed the way to a number of small but profitable modifications which have been and will be incorporated during installation of the second, third, and fourth units.

For instance, drains will be added to the feedwater system to allow blowdown to waste, in order to facilitate silica control as required after the system has been placed in operation.

Superheater outlet relief valves will be rearranged for easier accessibility in care and maintenance. Strainers in the boiler feed pump suction were originally of the basket removal type, but these are being replaced with units of the self cleaning type.

Will Use Venturi Type Feed Valves

Units 3 and 4 will be equipped with venturi type boiler feed valves to effect operation with an increase in velocity through the valve. Under the conditions encountered here, this is expected to result in a substantial savings in valve costs.

Another modification to the original design will be the removal of the turbine gland steam seal controller to the operating floor level. This will provide easier accessibility for operation and maintenance.

While such changes are of a minor nature, they appear desirable and should result in economies of benefit to the Ohio Edison Co. ╪

Photo on page 111 courtesy Dravo Corp.

Steam, Hot Water, Warm Air Serve Research Center's Complex Needs

By H. CARLTON MOORE
Chief, Mechanical Dept., and
FRANK M. GUNBY JR.,
Mechanical Engineer
Metcalf & Eddy
Engineers

THE TASK of providing heating and cooling services to a building used for particular industrial or commercial functions always poses a number of problems, which increase in complexity in direct ratio to an increase in special requirements on the part of the tenant.

Sometimes a variety of factors combine to make the design and installation of such a system "complicated" to the extent that simplicity is hard to attain. Put a number of buildings on the line, add a changing and sometimes severe climate, call for a broad flexibility that will serve numerous and dissimilar needs, and the result is a design problem such as the one described here.

The Avco Research Center, in Wilmington, Mass., houses the laboratories and administration facilities of Avco Mfg. Corp.'s Research and Advanced Development Division. The Center consists principally of a four-building complex enclosing more than 465,000 sq ft of floor space. Offices and a large number of laboratories for a variety of uses are located throughout the complex, and the four buildings are interconnected by a series of enclosed walkways.

Three of the four structures are of essentially two-story construction, with first floors located partially on grade. Because of the slope of the terrain, open spaces exist beneath parts of the buildings, which are supported on those exposures by a series of columns.

All three of these structures are completely air conditioned. A portion of the open areas beneath the first floors is used to house mechanical heating and cooling equipment and other miscellaneous mechanical items.

• Almost half a million sq ft of floor space on two levels is needed for the multiple research, development, and test operations carried on at the new Avco Research Center in Wilmington, Mass. A carefully evolved plan for heating services combines a central steam plant, hot water radiation units, and a low velocity air distribution system to provide flexibility in control and maximum use of available space in the four building complex. Separate chilled water systems in each building are used for summer comfort air conditioning and as part of a reheat dehumidification plan for computer and laboratory areas. Tempered makeup air is supplied to a high-bay shop and test building from which considerable air is exhausted.

Building No. 4 is a single-story, high-bay structure housing the Center's main shops and testing areas, plus additional offices and laboratories. These smaller spaces are located generally in a southeastern corner of the building and where necessary are supplied with mechanical comfort cooling during summer months.

Steam Does Double Duty

A steam generating plant with distribution to the various buildings was dictated by the fact that certain steam requirements for various laboratory and process work plus numerous equipment cleaning chores would be encountered.

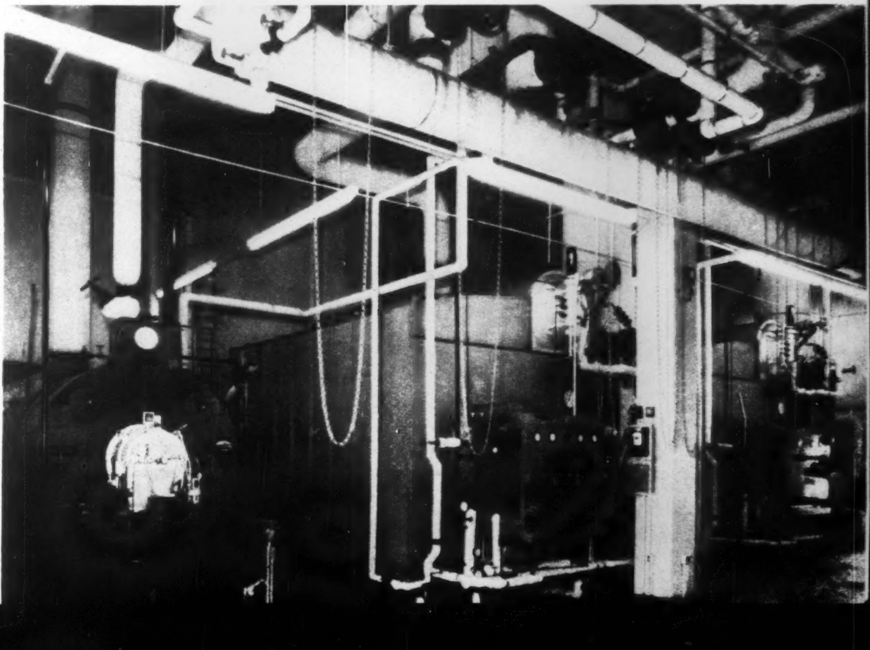
The central heating plant adjoins the test and shop facility. Oil or gas fired steam boilers with a maximum capacity of 65,000 lb of steam per hr furnish steam at a pressure of 125 psi to each of the four buildings in the complex.

In each of the two-story structures, called buildings 1, 2, and 3, both first and second floors were constructed with approximate 3 ft hung ceilings, above which heating and cooling coils and air supply ducts are located. This space above the ceilings is also used as a plenum for return air.

Heating is accomplished in the three buildings by a split system; with fin-tube baseboard radiation units supplemented by a low velocity warm air system. Such a system was chosen for several reasons.

Our familiarity with typical New England weather assured us that because of the large glass areas in these buildings, "window chill" near the outside walls could not be offset by heating with air only.

This factor was made more critical by the fact that buildings 1 and 3 are designed around a number of large interior light wells, each measuring approximately 75 by 50 ft, so that nearly all rooms had to be treated as exterior zones. All exterior walls have continuous 6 ft high windows of single pane glass.



CENTRAL STEAM PLANT furnishes up to 65,000 lb of steam per hr at 125 psi to steam-to-water heat exchangers in each of four buildings. Final heating distribution is by hot water and warm air

In addition, the enclosed walkways between buildings were to be heated but not cooled, and baseboard radiation or its equivalent was necessary in those spaces.

Finally, the architectural "base" in these buildings is that of the modular unit, designed with the expectation that interior partitions would be relocated at various times in the future to provide for expansion or reduction of research space given over to a particular use, conversion from laboratory to office space, etc.

Thus the comfort system had to be as flexible as the building itself and at the same time use as little floor space as possible.

The choice of steam for both these requirements and for heating, then, was quite natural. However, it became evident that the desired accuracy and sensitivity of temperature control in various parts of the complex could not be obtained with steam in the heating coils for each of the numerous zones, especially where only slight reheat was required for humidity control in the summer. We shall comment on the need for precise control a little later.

Use Steam, Hot Water, Warm Air

The final solution to the heating problem was effected by the design of the split system, with hot water as the final transfer medium. This is accomplished by means of steam-to-water heat exchangers located in the equipment spaces of buildings 1, 2, and 3. Hot water is delivered to the baseboard radiation units at a temperature of from 160 to 200 F, depending upon the outside temperature.

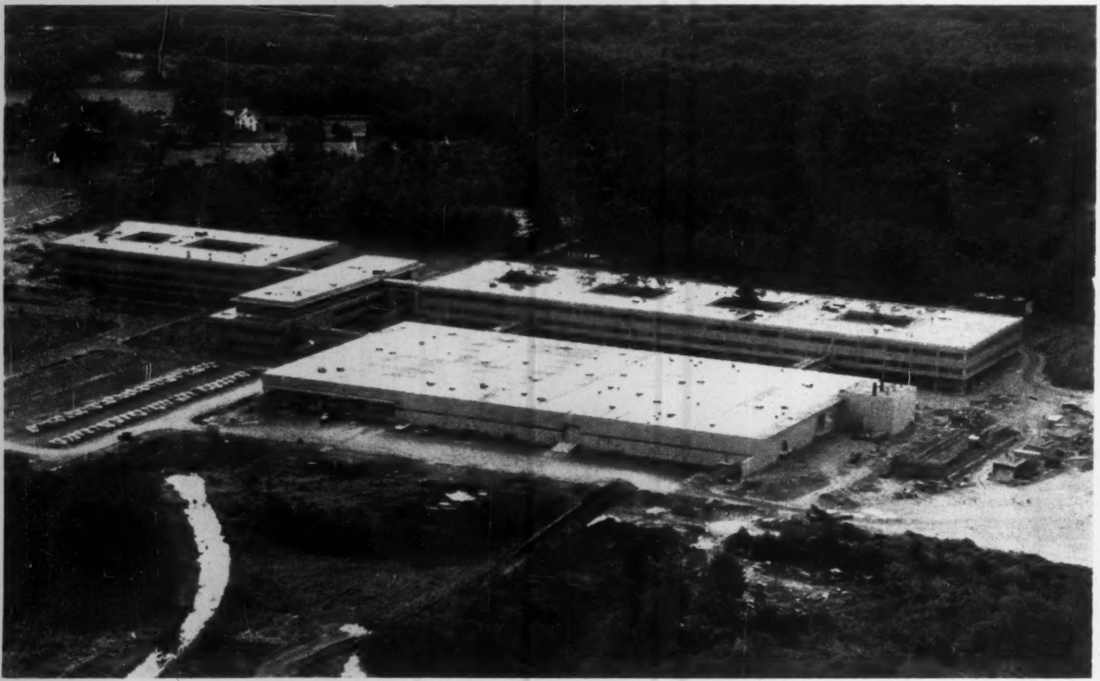
Hot water is also supplied to air duct heating coils located in each equipment room in order to temper the air supply for the supplementary warm air system. Water temperature here is 140 F.

Hot water supply temperature for each of these systems is controlled by a three-way mixing valve which serves to by-pass a portion of the returned water around the steam converter to maintain the required temperature.

Each of the equipment spaces in the three buildings also contains a centrifugal water chiller which supplies separate coils in each zone duct used for summer cooling. A cooling tower is located at the rear of the site at a slight elevation above the buildings. This cooling tower furnishes the condensing water for all of the mechanical spaces.

A central control cubicle is included in each of the mechanical spaces for the different zone controls required for the buildings.

In general, heating and cooling air distribution is under control of zone thermostats. During the summer months, dehumidification is accomplished by the cooling coils, which function under pneumatic control of a dewpoint sensitive element located in the ceiling return air plenum. In winter, heat is added as needed by zone heating coils controlled by space



AIR VIEW shows entire complex, buildings 1 and 3 with large interior light wells, covered walkways between buildings. In foreground is shop and test structure with central steam plant attached thermostats, while humidification is controlled by using pan-humidifiers with dewpoint sensitive elements in the fan discharge.

During the spring and autumn months, an economizer cycle is employed to circulate outdoor air when neither heating nor cooling is required. At such times, up to 100 percent outdoor air may be used to minimize mechanical heating and cooling requirements.

After consideration of these first three buildings in more detail, we will comment on the system employed for the fourth, or testing, structure.

Buildings referred to as Nos. 1 and 3 serve the research and development operations of the complex. These house various laboratories, offices, dark rooms, and machine shops. In addition, building 3 contains several special laboratories that require close control of temperature and humidity, plus a mathematics section that includes an IBM 704 computer.

Electronic Gear Gets Special Care

Several of the laboratories house electronic equipment, the proper calibration of which requires operation in ambient temperatures of 80 F or less. For this reason, building design temperatures were set at 76 F and 50 percent relative humidity. As noted previously, the changing requirements of the laboratories made the assignment of floor space subject to change for future projects. Therefore, flexibility of loads was important in the design.

To compensate for future needs, the supply air diffusers are located on a modular spacing to allow for future relocation of partitions, and those zones which are presently lightly loaded are furnished with oversized cooling coils to allow for future increased loadings.

Here the low velocity duct system distributes warm air during the winter and cool air in summer months. Air is returned from the spaces by means of strip return air grilles located in the ceiling along the exterior walls. This return location was selected in order to remove the effects of large heat gains between windows and venetian blinds before the added heat enters the occupied space.

These two buildings are zoned by occupancy and exposure. Again, the large light wells in the center required that most interior zones be considered as exterior spaces; this in turn necessitated a large number of small zones.

Space allotted to the mathematics section work is handled as a "separate" system. Two independently operating air distribution systems serve the IBM 704 computer area. One supplies conditioned air to the individual computer components by an underfloor duct system. A second provides comfort cooling by means of ceiling air supply. The combination serves to reduce the cooling load in the space and reduces the amount of supply air required for comfort conditioning; thus allowing a reasonable number of air changes per hr to eliminate drafts.

In the special areas requiring extremely close temperature and humidity control, the heating coil is regulated by an indicating thermal controller having proportional and automatic reset control functions located in the supply air duct, with control point reset by a recording thermal controller having proportional automatic reset and derivative functions located in the return air duct.

Cooling and dehumidification is accomplished by having the cooling coil automatically controlled by a similar thermal controller located on the discharge side of the cooling coil, plus a dewpoint sensitive element controller with proportional and automatic reset functions located in the return air duct.

The return air duct dewpoint sensitive element also controls the supply air duct-mounted humidifier. Under normal operation, the cooling coil dehumidifies and cools the air below the desired room conditions as sensed by the controller on the discharge side of the cooling coil. Reheat and humidification are added as required.

Reheat System Meets Control Limits

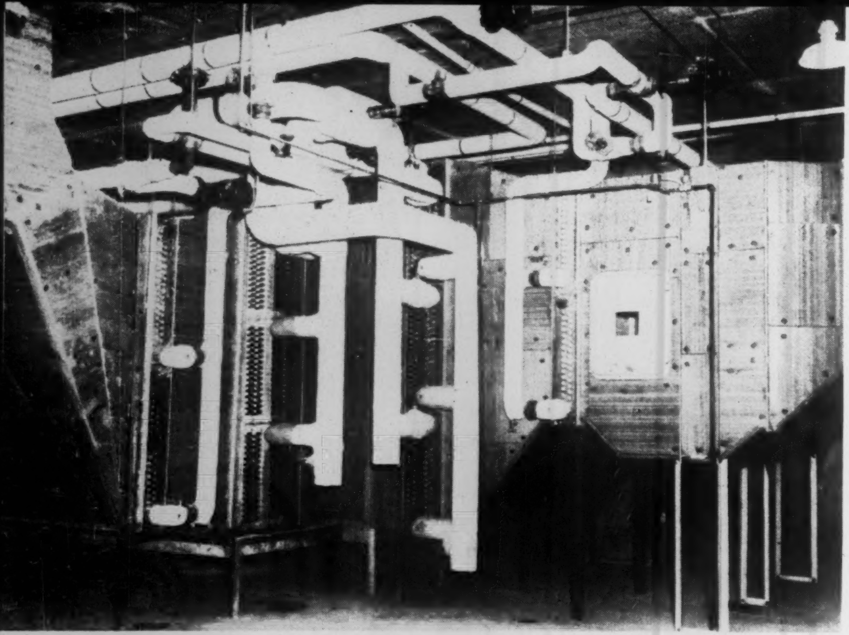
It might be interesting to note some of the limits for specific laboratory areas which have been met using this reheat operation. For instance, in the spectrograph laboratory we maintain a temperature of 72 F, ± 1 F, and 45 percent relative humidity, ± 3 percent. The reduction lab is supplied with 76 F air, ± 1 F, at 42 percent RH, ± 5 percent. For the metrology lab, the conditions are 68 F, ± 0.5 F, and 40 percent RH, ± 2 percent.

The computer room limitations are 75 F ± 5 F and 50 percent RH ± 5 percent for comfort conditioning, with 60 F air at a maximum RH of 60 percent supplied through the underfloor ducts to the computer components.

Throughout these laboratory areas, in the event that space humidity exceeds the allowable limits, the cooling coil control is taken over by the return air duct dewpoint sensitive element to cool the supply air below the setting of the cooling coil thermal element, thus effecting further dehumidification.

Isolation and Damping Control Noise

Since noise and vibration of substantial intensity could seriously affect the operation of laboratory equipment, large fans, pumps, and refrigerating compressors were installed on vibration absorbing pads. The location of this equipment in the mechanical spaces below the occupied building zones contributed to the effective isolation of any noise or vibration which might occur.



HEATING COILS, located in mechanical equipment spaces within each building, provide heated air through duct distribution system to various zones

Each supply air blower has a sound attenuator mounted on the discharge side so that little noise is transmitted through the low velocity air distribution system.

Administration Building Has Similar Systems

Building No. 2 serves as the administration center and houses the executive offices, main entrance lobby, auditorium, cafeteria, library, and other general offices.

There are no interior light wells here, but a perimeter strip at the north end of the building overhangs the foundation so that the floor is exposed to the atmosphere. Exterior walls have continuous 6 ft high single glazed windows and are similar in construction to those in the laboratory buildings.

Several of the rooms in the president's suite include one wall which is entirely of glass with a built-in sliding door. Since the use of fin type radiation units is precluded here, strip line supply air diffusers are located over the glass walls to provide compensation for heat loss through the windows. Return air registers are placed low on the wall in order to eliminate cold drafts at floor level.

The heating and summer cooling systems used in this building are similar to those described earlier with the exception of the zoning arrangement. Here each executive office comprises a separate zone for control purposes but all are divided into three general zones by exposure. Each of the three general zones is served by a single cooling coil which provides cooled air to all the office spaces. Separate heating coils are located in supply air ducts to each of the individual offices to permit individual temperature control for each room.

Because of their individual requirements, the main lobby, cafeteria, and auditorium are treated as separate zones, with the balance of the building zoned by exposure.

High-bay building No. 4, which houses the main shops and testing areas plus a number of office spaces, is divided by partial partitions which separate the various areas of use. Offices and laboratories in the southeastern corner of the structure are generally comfort air conditioned for summer use. Such spaces are enclosed by ceilings and are served by self-contained packaged units because of the small areas involved.

Supply Makeup Air to Building No. 4

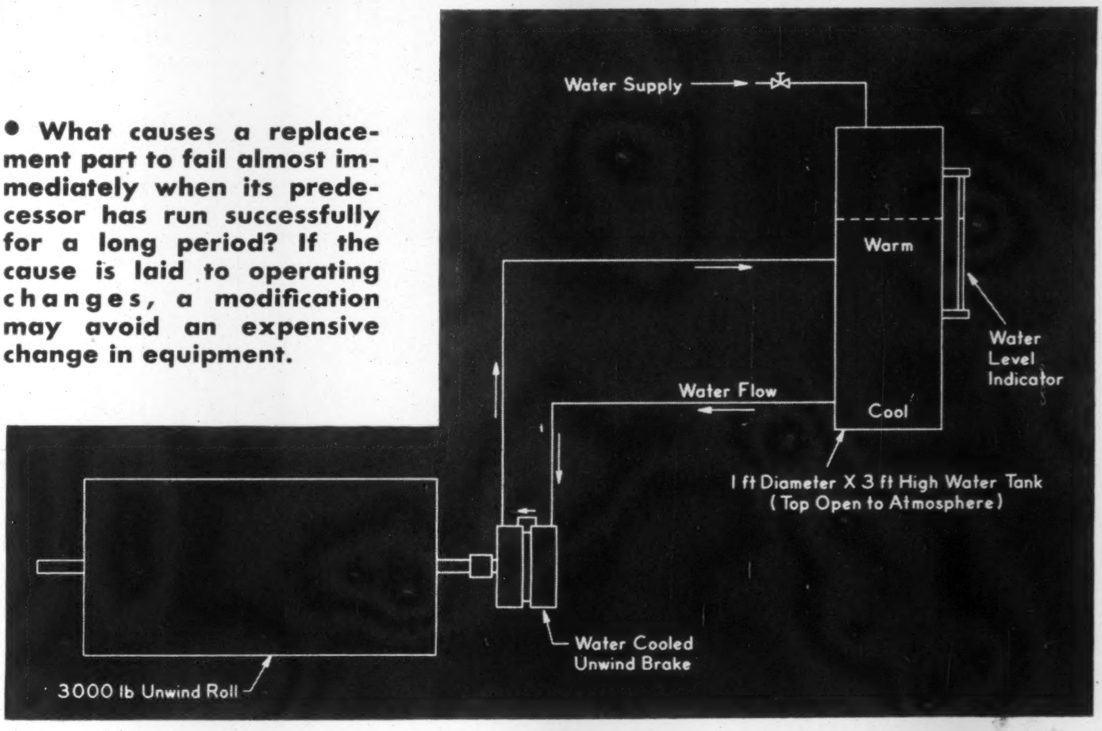
Considerable exhaust air is required in the testing laboratories and for certain of the shop equipment in the high-bay part of the structure. This requires a consideration for the supply of tempered makeup air.

Blower-type unit heaters are used in these areas to provide a mixture of outdoor and recirculated air as required. Most of the units are placed so as to blanket exterior walls with tempered air, with the remainder spaced throughout the interior to assure proper circulation. Hot water coils with face and bypass damper controls and safety devices to prevent freeze-up are installed.

In shop areas where the units are subject to freezing temperatures, vertical type unit heaters using medium pressure steam provide heating.

The entire project for the Center, comprising a total of about 1650 tons of air conditioning capacity, was completed in approximately 11 months. Fred Williams, Inc., was the mechanical contractor. The architects were Pereira & Luckman (now Charles Luckman Associates) and consulting engineers services were provided by Metcalf & Eddy, Engineers. ‡

• What causes a replacement part to fail almost immediately when its predecessor has run successfully for a long period? If the cause is laid to operating changes, a modification may avoid an expensive change in equipment.


Water Supply
Warm
Water Level Indicator
Water Flow
Cool
1 ft Diameter X 3 ft High Water Tank (Top Open to Atmosphere)
Water Cooled Unwind Brake
3000 lb Unwind Roll

Rewind Brake Gets "New" Cooling System

By KENNETH W. HUFFMAN
Plant Engineer
Western Waxide Division
Crown Zellerbach Corp.

THERE ARE TIMES in the life of a maintenance man when the obvious solution is somewhat elusive. Such was the case with a cast iron, water cooled jacket on the unwind brake of a high speed paper converting machine.

The normal requirement of the brake was to resist the flywheel effect of a jumbo roll of paper weighing approximately 3000 lb when the machine was decelerated from a web speed of 1200 fpm to a sudden stop in about seven seconds. The work of stopping the rotation of the unwind roll is transmitted in the form of heat from the brake lining to the surfaces of the cast iron jacket, the inner surfaces of which are in contact with the disc shaped lining.

After about three years of start and stop operation with only routine maintenance on the lining, the cast iron jackets developed water leaks on the face side next to the lining. It was assumed that time, wear, and heat had caused the failure, so a spare unit was installed. The next day a similar failure occurred in the spare casting.

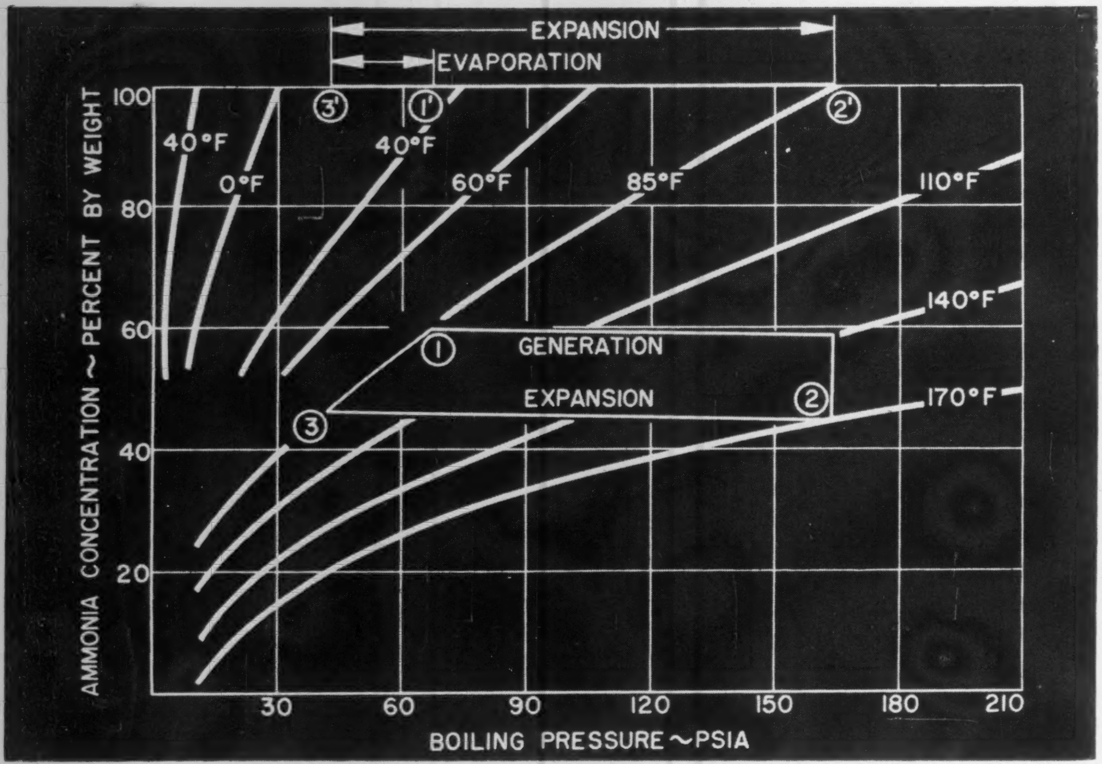
An investigation revealed that the deceleration rate of the machine had been increased to gain production time. The brake was now stopping the unwind roll in four seconds instead of seven. It appeared that it would be necessary to purchase a larger brake and adapt it to the machine in order to meet the new production demands.

Further analysis of conditions and a careful study of the cracks in the castings brought forth the thinking that the failures could have been due to differential expansion in the casting from the face next to the lining to the internal parts which had cool water (65 F) circulating through them.

In contrast to providing more cooling capacity in the form of lower temperature water, or increased circulation rate, it was decided to disconnect the circulating water system entirely and install a tank with float level feed as shown above. The water in the brake expands as it absorbs heat due to work, and convection forces the water to circulate slowly through the system as it warms to operating temperature.

Consideration was given to installing a thermostat in the piping on the outlet side of the brake, but this has not been necessary. The convection tank is not susceptible to mechanical failure, and has even kept the interior of the brake castings free from the sediment usually present in circulating water from cooling towers.

This cooling system has been in operation for about 18 months with no failures. The sight glass was added as a convenience to the operator to be sure there is water in the tank before starting the machine. ‡



1 **PRESSURE-TEMPERATURE-CONCENTRATION relationships for absorption refrigeration system using solar-heated hot water for regeneration, liquid ammonia for heat storage are shown above**

Tests Prove Feasibility Of Solar Air Conditioning

. . . with an ammonia - water absorption refrigeration system

BY MELVIN EISENSTADT
Propulsion Engineer
The Martin Co.

FRANK M. FLANIGAN
Associate Professor
University of Florida

ERICH A. FARBER
Research Professor
University of Florida

Air conditioning is a natural application of solar energy since the sun is used to overcome its own discomforting effect. The near coincidence of maximum cooling load with the period of greatest solar radiation is an advantage, since the greatest cooling effect is available when needed most.

The literature is rich with information concerning the relative effectiveness of both concentrating and flat-plate absorbers. The concentrators collect solar energy at high temperatures. However, they are expensive, difficult to fabricate, and depend upon direct, practically uninterrupted sunshine for effective operation. The flat-plate absorbers, on the other hand, are more economical, are easier to build, and are able to collect diffuse as well as direct solar radiation.

While the flat-plate absorber can be better integrated into the architecture of buildings, its major

The engineering features of an ammonia-water absorption refrigeration system utilizing hot water from a flat-plate solar absorber for regeneration are discussed in this article as a means of comfort cooling with solar energy. The temperature of the hot water used for regeneration varies from 140 to 180 F, a range readily obtained with present-day commercial flat-plate absorbers. An intermittent cycle was tested and the resultant performance data is reported here. The objectives of this study were: (1) to determine the effects of hot water temperature and ammonia concentration on system performance; (2) to evaluate the practicality of the system; and (3) to apply the results of an intermittent cycle to a continuous cycle. The data collected indicate that such a system is thermodynamically feasible.

disadvantage lies in the utilization of the energy which it has collected at relatively low temperatures. (The maximum for commercial units is about 200 F.)

This article describes an ammonia-water absorption refrigeration system which could operate with solar energy from a flat-plate absorber. The sun would be used to heat water to 140 to 180 F and the hot water would regenerate the system.

This unit has definite advantages. As mentioned, the flat-plate absorber provides an economical, easily assembled device for collecting energy. Its ability to collect diffuse radiation would provide some cooling on cloudy days. The near coincidence of greatest cooling load with maximum solar insolation tends to minimize the energy storage problem. Storage is further simplified by collecting liquid ammonia instead of hot water. Ammonia has a potential cooling effect equal to its heat of vaporization (about 520 Btu per lb). Hot water has an energy content proportional to its specific heat and temperature, i.e., $Q = C_p \triangle T$; where Q is the available energy per pound. Since hot water would be stored at a maximum of 180 F, the liquid ammonia storage tanks would be small compared to hot water tanks. Liquid ammonia can be stored at ambient temperatures, eliminating the need for insulation.

Absorption Refrigeration Dates Back to 1824

The principles of absorption refrigeration were first used by Faraday in 1824. He vaporized ammonia to produce a refrigerating effect and then adsorbed the refrigerant with silver chloride in a closed system.

Refrigeration has been obtained from solar energy by several devices. Wilson P. Green coupled a flat-plate absorber to a parabolic concentrator[1]. This combination produced steam which operated a steam-jet air conditioner. He concluded that the high initial cost and size of the energy collecting apparatus made such a device impractical.

Felix Trombe and Marc Foex developed a solar refrigerator with practical capacities[2]. Their device used an ammonia-water absorption system with intermittent operation. A cylindro-parabolic mirror with an area of 1½ sq m was used as the collector. Generation occurred during the 4 hr of maximum sunshine, with evaporation the remainder of the time. This unit produced 6 kg of ice per day.

G.O.G. Lof has constructed an air dehumidifier in which a desiccant is regenerated with solar-heated air[3]. Triethylene glycol is used to absorb moisture from incoming air. The water is later stripped from the solution by hot air coming from a flat-plate absorber. Dry air from the unit can be cooled either by evaporative cooling or refrigeration.

Williams, Chung, Lof, Fester, and Duffie built a device similar to that of Trombe and Foex[4]. They tested four possible absorption and adsorption combinations: methanol-silica gel, acetone-silica gel, ammonia-water, and refrigerant No. 21-glycol ether. Generation occurred in the neighborhood of 260 F. The ammonia-water combination was most effective.

R. K. Chari compared several absorption-refrigeration combinations with generation at flat-plate absorber temperatures[5]. Once again the ammonia-water combination proved most advantageous.

Scope of Present Investigation

The present investigation was, to some extent, an extension of the work done by Chari at the University of Florida. The ammonia-water system appeared promising; hence, a system was fabricated to determine the effects of certain variables on performance. An intermittent cycle was selected because of its inherent simplicity. However, the principles hold equally well for continuous systems.

Two quantities were varied during the tests: (1) The maximum hot water temperature during generation ranged from 140 to 180 F in 10 F increments. 2) The concentration of ammonia in the ammonia-water solution at the initiation of generation was varied from 40 to 70 percent in 10 percent increments.

The effects of these two variables on four system parameters were ascertained. The parameters were coefficient of performance, evaporator temperature, quantity of ammonia generated, and cooling rate. Well water was used as the cooling medium for condensing and absorbing. The temperature of the water varied from 70 to 72 F during the test program, and was therefore treated as a constant.

---

[1] Numerals refer to references at end of text.

Curves showing the nature in which the two variables affect the four parameters are presented elsewhere in this article. These are good indication of the thermodynamic practicality of the system. By using these results judiciously, a system operating with a continuous cycle can be designed.

Relate Pressure-Temperature-Concentration

The pressure-temperature-concentration relationships[6] for the ammonia-water combination are shown in Fig. 1. An intermittent cycle is superimposed on the curves. Points 1, 2, and 3 refer to generator-absorber conditions, while 1′, 2′, and 3′ correspond to conditions in the condenser-evaporator.

Heat is added to the generator-absorber contents beginning at point 1, until the vapor pressure of the solution is equal to the condensing pressure of the ammonia at the coolant temperature (85 F is assumed). Further addition of heat increases the temperature of the generator-absorber contents which results in the evolution and subsequent condensation of ammonia.

Generation is completed when the generator-absorber contents correspond to point 2 and condenser-evaporator contents are at 2′. The generator-absorber is then cooled to the coolant temperature. This is accompanied by rapid boiling of the ammonia in the condenser-evaporator, and a consequent decrease in the refrigerant temperature.

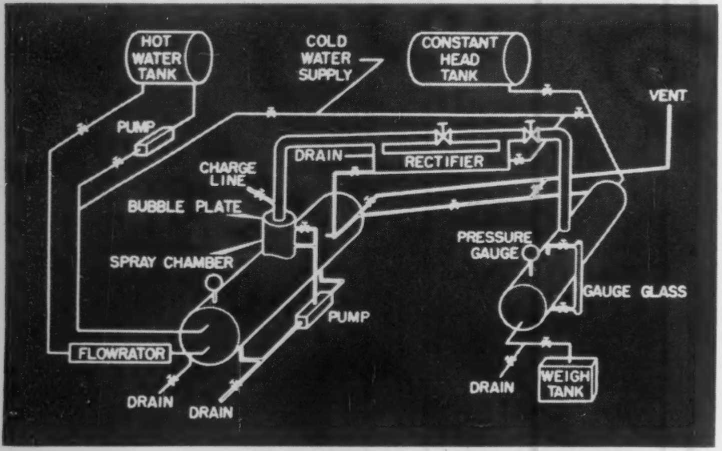
The process is analogous to a refrigerant flowing through an expansion valve, and is shown in Fig. 1 by the paths from 2 to 3 and 2′ to 3′. The evaporation process is shown by the paths from 3 to 1 and 3′ to 1′.

The generator-absorber remains at the temperature of the coolant during evaporation; however, the ammonia concentration of the generator-absorber contents increases. This is caused by absorption of the refrigerant boiled in the evaporator-condenser. The increasing concentration causes a corresponding rise in the equilibrium pressure of the system, and a consequent increase in the boiling temperature of the refrigerant. The path from 3′ to 1′ shows that the temperature varies from 15.9 to 36.3 F for this particular cycle.

Fig. 1 indicates that the boundaries of the cycle are determined by three quantities: temperature of the heating medium used for generation, coolant temperature, and ammonia concentration at the beginning of generation. The first of these is limited by the temperatures obtainable from a flat-plate solar absorber. The second is fixed by the cooling medium used. The third quantity, however, can be widely varied.

Assume that a higher initial ammonia concentration had been used in the previous example. The resultant cycle would have a slightly higher average evaporator temperature during evaporation, but a greater quantity of ammonia generated. This might appear advantageous since the evaporator temperatures would still be suitable for comfort-cooling applications.

The same logic could be applied to still higher ammonia concentrations. As the concentration increases, however, the absorption rate and cooling rate diminish. These important considerations place a practical limit on the initial ammonia concentration.



2 SYSTEM used for tests consisted of three shell-and-tube heat exchangers and associated components. Hot water tank was used instead of flat-plate absorber to facilitate accurate temperature control required for tests

TABLE 1 — RESULTS OF TESTS to determine feasibility of solar air conditioning with ammonia-water absorption refrigeration system are tabulated below

Run No.	Ammonia concentration, percent	Maximum generator water temperature, F	Actual heat in, Btu	Calculated heat in, Btu	Ammonia evaporated, lb	Actual coefficient of performance	Probable coefficient of performance	Cooling data, Btu per hr	Probable cooling obtained, percent	Lowest evaporated temperature, F
1	40	180	.....	.....	0.09	....	....	....	...	...
2	50	150	8,070	7,935	2.68	0.138	0.177	....	78.0	25.0
3	50	160	9,654	9,616	5.64	0.208	0.312	4,035	66.7	18.0
4	50	170	12,953	12,924	9.38	0.251	0.389	4,480	64.4	17.0
5	50	180	14,450	14,972	11.40	0.301	0.426	4,990	70.5	14.5
6	60	140	9,934	9,076	7.72	0.334	0.411	2,862	81.4	35.0
7	60	150	11,036	10,794	10.13	0.383	0.480	3,100	79.7	33.0
8	60	160	13,670	13,223	13.78	0.416	0.533	3,480	78.0	28.5
9	60	170	16,451	15,982	16.64	0.412	0.536	3,460	76.1	26.0
10	60	180	18,282	17,754	18.30	0.393	0.533	3,900	73.8	27.0
11	70	140	11,832	11,222	13.77	0.463	0.585	1,770	79.3	45.0
12	70	150	13,880	13,259	16.64	0.472	0.621	2,550	75.8	43.0

Commercial ammonia-absorption systems usually operate with a high temperature energy source (steam or a gas flame). High temperatures permit operation at low ammonia concentrations; generally below 50 percent. The combination of high-temperature source and low concentration produces high cooling rates and low evaporator temperatures — low enough for food storage and ice production in the case of domestic refrigerators.

The temperature range available for generation in this investigation requires high ammonia concentrations if the cycle is to produce any usable results. The uniqueness of these tests lies in the temperature and concentration ranges investigated.

Shell-and-Tube Heat Exchangers Used

The intermittent system that was fabricated for these tests was composed of three shell-and-tube heat exchangers, auxiliary components, instrumentation, and associated piping.

The generator-absorber was a 40-tube, four-pass heat exchanger, 6 ft long with a 6 in. ID. The evaporator-condenser consisted of a shell 6 ft long with a 4 in. ID, containing a nine-tube, three-pass tube bundle. The rectifier was a single-pass heat exchanger, 3 ft long and 2 in. ID, with four tubes. All tubes were 3/8 in., Schedule 16 mild steel.

A schematic of the system is shown in Fig. 2. A thermostatically controlled hot water tank was used in lieu of a flat-plate absorber since the tank permitted accurate temperature control. Hot water was circulated through the generator by a pump. A bubble-plate analyzer was included in the generator-absorber design to intercept any water entrained in the gaseous ammonia during generation. The refrigerating effect obtained during evaporation was used to cool water flowing through the evaporator. This water came from a constant-head tank, thus insuring a constant flow rate.

Adequate mixing of the ammonia-water and gaseous ammonia during absorption was enhanced by four spray nozzles and a 1/16 hp ammonia-water pump. Cooling water was circulated through the apparatus by a well pump. Instrumentation was installed to measure all pertinent quantities.

Use 3 Part Experimental Procedure

The experimental procedure can be considered in three parts: charging, generating, and evaporating. The quantities of ammonia and water to be charged into the system for each particular concentration were calculated, based on a generator-absorber volume of 1.085 cu ft. The system was then evacuated by a vacuum pump and the calculated quantities were charged.

Generation required cooling of the condenser, operation of the rectifier, and heating of the generator. Cooling water was circulated through the condenser and rectifier while hot water was pumped through the generator. The hot water temperature was increased as the run progressed until it reached the desired value for the run. It was then maintained at this value. A gage glass was included in the condenser design so the ammonia level in the condenser could be observed.

Generation was considered complete when the hot water temperature had reached its predetermined value and no increase in the ammonia level was observed for 15 min. Data was recorded at 5 min intervals.

The generator-absorber and condenser-evaporator were isolated from each other at the end of generation by closing the interconnecting valves. Water valves were manipulated to permit the circulation of cooling water through the absorber and to stop the flow of coolant to the rectifier. Water from the constant-head tank passed through the evaporator. As the weak ammonia-water solution in the absorber cooled, absorber pressure decreased. When the absorber contents approached temperature equilibrium with the coolant, the spray system was actuated, interconnecting valves were opened, and evaporation commenced. Data was recorded at 5-min intervals. Evaporation was considered complete when no ammonia could be observed in the gage glass on the condenser-evaporator.

All data necessary for plotting the curves included in the next section was recorded. Data required for heat balances was taken, and a comparison between the heat balances calculated from theoretical considerations and those computed from this data is shown in Table 1. Maximum system pressure was 142 psi and occurred during run No. 12.

The system was discharged and refilled each time the ammonia concentration was changed. Hence, each run was made with the same volume of aqua ammonia (1.085 cu ft).

Evaluate Results of Tests

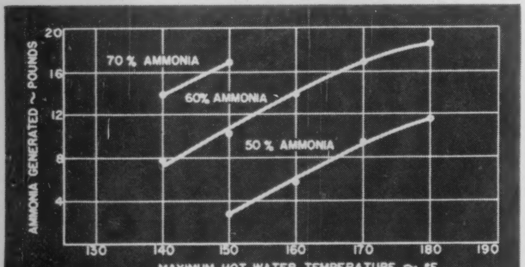
The anticipated performance of the system was predicted from the temperature-pressure-concentration relationships given in Fig. 1. The calculations, made during the preliminary system analysis, exerted the major influence on design parameters. Actual results were generally better than anticipated.

The effect of the two variables on the four parameters will now be considered. Again, the variables are maximum hot water temperature and ammonia concentration. The parameters are:

1) Quantity of ammonia generated
2) Cooling rate
3) Coefficient of performance
4) Minimum evaporator temperature.

Quantity of ammonia generated. The curves in Fig. 3 indicate that the weight of ammonia generated increases with both higher concentrations and higher water temperatures, as was expected. The slope of the curves diminishes towards the right, disclosing that, as the maximum water temperature rises, the weight of ammonia generated increases at a decreasing rate.

The maximum weight of ammonia generated was 18.30 lb during Run 10 (180 F at 60 percent). This quantity completely filled the condenser-evaporator and part of the interconnector. Condenser-evaporator size consequently placed a limit on the extent of testing, and the final run was made at 150 F and 70 percent.



3 WEIGHT OF AMMONIA generated increases with increase in concentration and temperature

Cooling rate. The curves in Fig. 4 show that the cooling rate increases with a decrease in concentration and/or an increase in the maximum hot water temperature. The slope of the curves becomes steeper to the right, showing that the cooling rate rises at an increasing rate as the hot water temperature goes higher. These trends agree with theory.

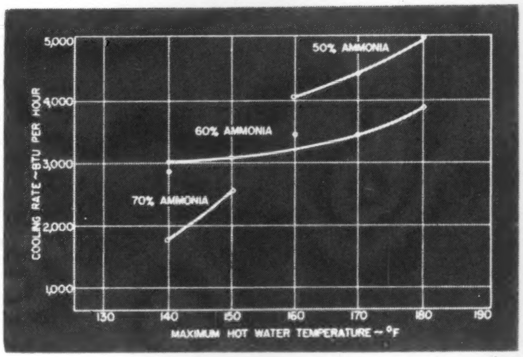
The cooling rate is determined by the rate of ammonia evaporation. Evaporation rate is a function of two factors; namely, the rate at which heat is added to the refrigerant and the rate of absorption of the gaseous ammonia. Absorption rate, in turn, depends upon absorber temperature and the effectiveness of the spray chamber. Both these quantities were fixed. The rate of heat addition to the refrigerant is determined by the heat transfer parameters described in the familiar one-dimensional Fourier equation, $Q = UAdt/dx$.

Cooling rate is the most flexible of the system parameters since it is a function of evaporator and spray chamber design as well as a function of the two variables being considered. An increase in water flow rate through the evaporator would cause a rise in the values of both the overall heat transfer coefficient and the temperature gradient, and a consequent rise in Q. The temperature drop of the water flowing through the evaporator would decrease, however, as flow rate increased. A compromise between these factors must be reached for each system. The effect of variations in the heat transfer area is obvious.

A water flow rate of 2.5 lb per min was used in this system. Low flow yielded a large temperature differential in the water flowing through the evaporator and thus helped minimize any instrument error. This flow rate, however, caused laminar flow through the tubes and reduced the heat transfer rate appreciably. In addition, the heat-transfer area decreased as the quantity of ammonia in the evaporator decreased, because the tubes in the evaporator tube bundle were symmetrically spaced. These factors reduced the cooling rate. An improved condenser-evaporator design would yield values higher than those shown in Fig. 4.

Coefficient of performance. Two families of curves are shown in Fig. 5: actual coefficient of performance and probable coefficient. The dual curves were the result of a discrepancy between the experimental data and the calculations.

The actual coefficient is the ratio of heat input to refrigeration effect obtained; both quantities being determined by heat balance calculated from experi-



4 COOLING RATE increases with a decrease in concentration and/or an increase in hot water temperature

mental data. The probable coefficient is the ratio of the heat input (measured by the heat balance) to the calculated refrigeration effect.

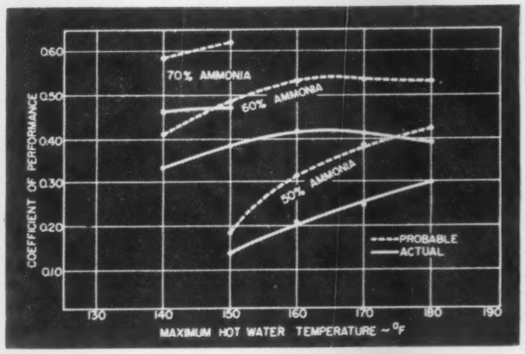
The calculated effect is the product of the weight of ammonia in the evaporator at the initiation of evaporation and the latent heat of evaporation at system pressure. The magnitude of the discrepancy is shown by Table 1 in the column, "Probable cooling obtained, percent," and ranges from 64.4 to 81.4 percent.

This deviation is due to liquid ammonia becoming entrained in the gas during evaporation since no baffles were included in the system. The curves show that the magnitude of the discrepancy between the curves increases with both higher concentrations and with a rise in maximum hot water temperature. These factors are explainable by the liquid carryover hypothesis. The curves showing probable coefficient are very realistic, and can be achieved with adequate baffling.

Coefficient of performance increases at a decreasing rate as ammonia concentration rises. The curves also tend to reach their maximums as the hot water temperature increases. The only curve actually showing a maximum is the 60 percent concentration curve. However, both the 50 percent and the 70 percent curves are increasing at decreasing rates. Extrapolation of the curves yields maximums at approximately 155 F at 70 percent and 200 F at 50 percent.

Minimum evaporator temperature. Minimum evaporator temperatures well below freezing were obtained. The curves in Fig. 6 indicate that the lowest evaporator temperature diminishes with a decrease in ammonia concentration, and tends to reach a minimum value as the hot water temperature increases. This behavior is all in accordance with theory.

Variation of two important parameters with respect to time can be derived from the data. Two curves are presented for Run 8 (60 percent at 160 F). Fig. 7 shows evaporator temperature as a function of time, while Fig. 8 treats the temperature decrease of the water flowing through the evaporator in the same manner. The inter-dependence of these curves is apparent.

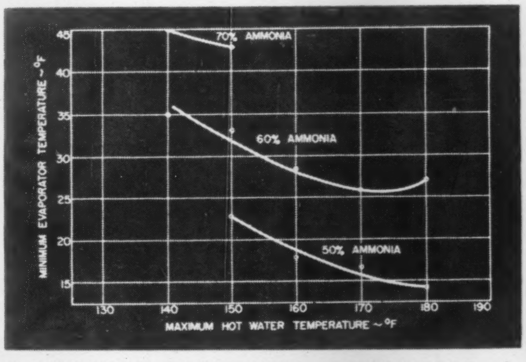


5 TWO FAMILIES of curves reflect actual and calculated coefficients of performance for test apparatus

Evaporator temperature fell sharply during the first 15 min of evaporation. This corresponded to the expansion explained in the theoretical cycle discussion. The gradual temperature increase from 15 to 120 min was the result of a gradually increasing ammonia concentration in the absorber and the progressive decrease of the heat transfer area in the evaporator. The effect of the diminishing heat transfer area became pronounced at 120 min, and the steep rise of the curve from this point to the end of evaporation is attributed to evaporator geometry. Data for constructing similar curves for any of the runs in this investigation are available[7].

The water temperature decrease depended upon the evaporator temperature since the flow rate remained constant. The maximum water temperature decrease occurred after about 10 min, or 5 min before the evaporator temperature was at its minimum. The time difference is due to the decreasing heat tranfer area in the evaporator. The water temperature decrease diminished gradually until 120 min had elapsed, at which point the evaporator geometry caused a definite change in the slope of the curve.

The 60 percent concentration yielded the best results from a practical viewpoint. The coefficient of



6 MINIMUM EVAPORATOR TEMPERATURE decreases with a decrease in ammonia concentration performance ranged from 0.411 to 0.533 for the probable and from 0.334 to 0.416 for the actual. These values are reasonable, considering that perfected commercial units operate at a coefficient of performance of about 1.

Cooling rates were also of a practical order of magnitude at this concentration, ranging from 2860 to 3900 Btu per hr, or from about 1/4 to 1/3 ton. The temperature of the water cooled in the evaporator varied from 35 to 68 F and consequently was usually in the range required by air conditioning systems.

The system was flexible. The coefficient of performance could be increased at the expense of the cooling rate, or vice versa, by varying the ammonia concentration. Higher cooling rates could be obtained by increasing the flow rate, although this would increase the temperature of the evaporator outlet water. This variation could also work in the reverse direction.

The 60 percent concentration yielded the best compromise of the variables for a practical system.

Offer Continuous Systems Possibilities

Effective air conditioning requires a continuous refrigeration cycle unless cooling potential is stored in the form of a cold substance. Two possibilities for continuous systems are presented here:

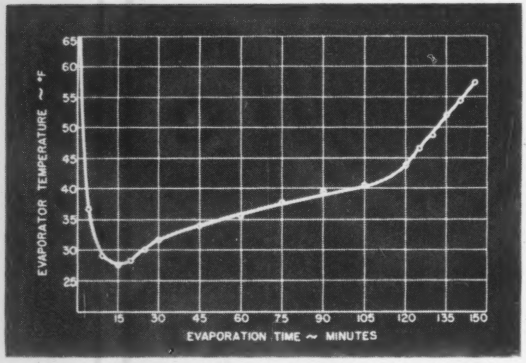
The first consists of two intermittent systems operating alternately from the single flat-plate absorber. System 1 would be evaporating while System 2 was generating. At the completion of evaporation, System 1 would be regenerated while System 2 evaporated, thus assuring a continual source of cooling. The intermittent system has inherent fluctuations in cooling rate and evaporator temperature, however, and temperature control might prove difficult.

The second is a conventional continuous system with storage capacity coupled to a flat-plate absorber. This system is advantageous since steady flow conditions are achieved, thus reducing temperature control problems. The exchange of heat between the weak and strong ammonia-water solutions in this system would cause a small increase in coefficient of performance.

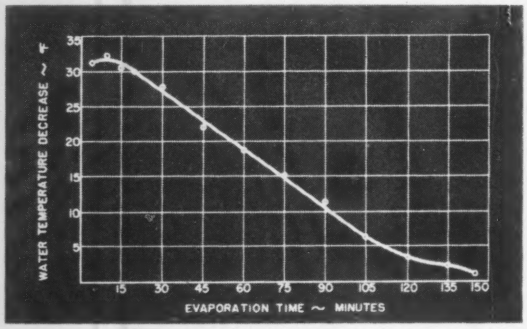
Conclusions Drawn from Study

Solar air conditioning, using an ammonia-water absorption system coupled to a flat-plate absorber, is thermodynamically practical. Realistic values of coefficient of performance, cooling rate, and cold water temperature were obtained by utilizing hot water in the temperature range of 140 to 180 F as the energy source. These results were obtained with ammonia concentrations which were quite high by conventional standards, ranging from 40 to 70 percent. Values of system parameters could be varied by changing ammonia concentration and/or hot water temperature, giving a large degree of flexibility within the operating range.

Ammonia and water constitute a particularly advantageous combination for absorption refrigeration systems with solar regeneration. This is attributed to both the pressure-temperature-concentration relationships of the combination and high latent heat of ammonia. High latent heat results in smaller equipment sizes as well as good thermodynamic performance. ⌖



7 EVAPORATOR TEMPERATURE as function of time is shown above. Data is for Run 8



8 TEMPERATURE OF WATER flowing through evaporator is shown here for same run as in Fig. 7

References:

[1] *The Utilization of Solar Energy for Air Conditioning and Refrigeration in Florida*, by W. P. Green. Unpublished Master of Science thesis, Dept. of Mechanical Engineering, University of Florida, 1936.

[2] *The Production of Cold by Means of Solar Radiation*, by F. Trombe and M. Foex. The Journal of Solar Energy Science and Engineering, Vol. 1, January 1957.

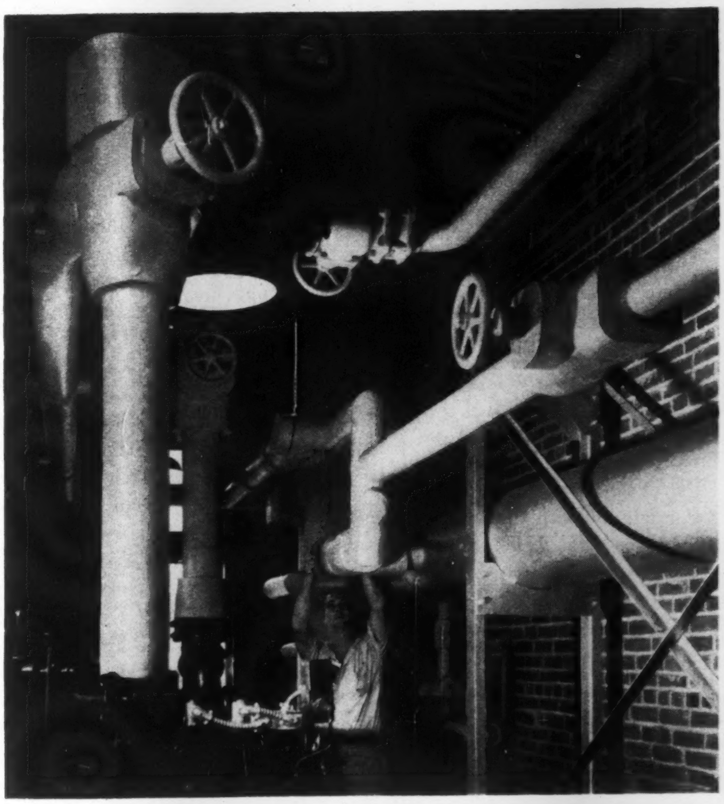
[3] *Cooling with Solar Energy*, by G. O. G. Lof. Proceedings of the World Symposium on Applied Solar Energy, Phoenix, Ariz., 1955, Stanford Research Institute, 1956.

[4] ASME Paper No. 57-A-260, Williams et al, 1957.

[5] *An Investigation of the Use of Solar Energy for Absorption Refrigeration*, by R. K. Chari. Unpublished Master of Science thesis, Dept. of Mechanical Engineering, University of Florida, 1958.

[6] *Principles of Refrigeration*, by W. H. Motz. Nickerson & Collins Co., Chicago, 1952.

[7] *An Investigation of An Ammonia-Water Absorption System for Solar Air Conditioning*. M. M. Eisenstadt. Unpublished Master of Science thesis, University of Florida, 1959.



Size Suction Lines For True Economy

• **The operating efficiency obtained from an air conditioning system depends to a large extent upon correct sizing of the suction line to the refrigerating plant. To insure that power costs will be kept to a minimum, published data for "standard ton" conditions should be checked carefully. Otherwise, pressure drop may be excessive. High power costs subtract directly from the owners profit.**

By HERMAN VETTER
Vetter Engineering Co.
Industrial Consulting Engineers

ALL TOO OFTEN data that is used has no foundation in fact. Most engineers will not hesitate to use published data, believing that it is authentic. No greater fallacy exists than that which pretends that because a thing is in print it must be authentic. The indiscriminate use of such figures can lead to faulty conclusions. Let us cite a simple example to show how unwise this is.

In the refrigerating plant for an air conditioning system, the suction line has a large influence on the operating efficiency. In determining the size of this line, most engineers use the data published in a standard in which it is stated that a 6 in. line is sufficient for up to 306 tons cooling capacity when operating at 19.6 psi suction and 154.5 psi condensing pressure — or what is known as "standard ton" conditions. But at this capacity the results would be as follows:

Capacity	306 tons
Vapor velocity	5240 fpm
Reynolds Number	31,574
Pressure drop, psi	17.5
Volumetric efficiency, percent	39.97
Total brake hp	1,369.656
Hp per ton	4.476
Compressor displacement required	1120 cfm
Power cost per yr	$89,180.00

It might be said that we are considering only an extreme example. Let us therefore consider what the conditions would be if we use a 6 in. line for 275 tons of cooling capacity instead of for 306 tons. At this capacity the results would be as follows:

Example 2:

Capacity	275 tons
Vapor velocity	4710 fpm
Reynolds Number	29,500
Pressure drop, psi	7.038
Volumetric efficiency, percent	67.78
Total brake hp	555.0
Hp per ton	2.02
Compressor displacement required	660.46 cfm
Compressor suction pressure, psi	12.562

If the plant were designed by a competent consulting engineer retained by the plant owner, the consulting engineer would strive to design a plant for the most practical, efficient operation under all conditions.

Successful business men are primarily interested in having the lowest cost of operation. Naturally, when determining the unit cost of operation, the capital investment, depreciation, and other incidental items must be considered. Unit cost as used here means the amount of cost involved in cooling a sq ft of area for comfort or other purposes.

It would be well to recall here that if the power cost of any plant can be reduced by $10,000.00 per yr, net profit increases by exactly that amount, since no deductions from the gain are necessary.

Pressure Drop Should Be 1 Psi or Less

A consulting engineer conscious of his responsibility to the owner would not specify a suction line with a pressure drop of more than 1 psi, if possible. If a plant is designed on this basis, the result will be as follows:

Example 3:

Capacity	306 tons
Size of suction line	12 in.
Vapor velocity	177.66 fpm
Reynolds Number	1606
Pressure drop, psi	0.784
Volumetric efficiency, percent	87.50
Total brake hp	414.936
Hp per ton	1.356
Compressor displacement required	510.47 cfm
Compressor suction pressure	19.6 psi
Power cost per yr	$27,092.00

The last analysis does not quite give a fair comparison because Example 2 is based on 275 tons cooling capacity whereas the first and third cases are based on a capacity of 306 tons. If the power cost of all three examples is keyed to 306 tons capacity, however, the results compare as follows:

Example 1	$89,180.00
Example 2	40,721.00
Example 3	27,092.00

These are figures based on an electric rate of one cent per kwh.

For a plant to operate under conditions such as stated in the first example would require compressors with 2.19 percent greater capacity than for a plant operating under the conditions of Example 3.

A plant operating under the conditions of Example 2 would require a compressor capacity 1.29 percent greater than that needed for Example 3, even though in the second case the capacity is 275 tons vs 306 tons in the third instance.

Higher Speeds Will Increase Costs

This analysis is based on the use of a slow speed compressor. If the compressors considered operate at speeds in excess of 360 rpm, the volumetric efficiency would be reduced, and consequently, power cost would rise still higher.

We believe that all published data should include information as to its "origin." The tendency too often is to look for quick formulas. As indicated by the foregoing, a properly designed plant would cost less initially than one improperly designed because smaller motors and compressors would be required for the more accurate job. Such a difference would more than offset the cost of the larger suction line.

The important conclusion to be drawn from all this is that all data, even that in print, should be used with extreme caution. We have found it wise to check manufacturers' capacity ratings, and in cases where an adequate check cannot be accomplished, to select an oversize unit. ⌗

Photograph courtesy Armstrong Cork Co.

THE
CHICAGO
PLAN
for
SEPARATE
MECHANICAL SPECIALTY
CONTRACTING
BIDS

COORDINATING
COMMITTEE
of Mechanical
Specialty Contractors
Associations of Chicago

BROCHURE being distributed to architects, consulting mechanical engineers, and owners of large commercial and industrial buildings discusses evils of present bidding practices, outlines "Chicago Plan" to curb malpractice by awarding separate mechanical contracts in each of four specialties

Mechanical Specialty Contractors
Devise New Bidding Plan

It is the firm conviction of the Coordinating Committee of the Mechanical Specialty Contractors Associations of Chicago that construction costs can be reduced, and bid shopping, bid peddling and broker contractors can be eliminated by means of the following recommended procedure:

- **A) Prepare separate specifications for each of the four categories of mechanical specialty work, namely:**
  - **1) Plumbing and sewerage.**
  - **2) Heating, piping, refrigeration and automatic temperature control systems.**
  - **3) Ventilating and distribution systems for conditioned air.**
  - **4) Electrical installations.**
- **B) Take separate bids from reputable contractors on each of the four above classes of work.**
- **C) Let separate contracts to the four low bidders, if qualified.**
- **D) Provide for optional assignment of mechanical specialty contracts.**
- **E) Stipulate direct payments to the mechanical specialty contractors, in the event contracts are assigned.**

EFFORTS TO CURB the practices of bid shopping and bid peddling in mechanical specialty work by general contractors are making good progress in the Chicago area. The movement, known as the "Chicago Plan for Separate Mechanical Specialty Contracting Bids," is more briefly stated by those in the construction industry as the "Chicago Plan." This plan is the achievement of a coordinating committee of Mechanical Specialty Contractors' Associations of Chicago, consisting of representatives from: Mechanical Contractors' Chicago Association; Ventilating and Air Conditioning Contractors' Association of Chicago; Electrical Contractors' Association of Chicago; and Plumbing Contractors' Association of Chicago.

a new idea in bidding

The coordinating committee believes that separate bids should be taken by architects, engineers and other awarding agencies in each of four categories of mechanical specialty work, namely:

1) Plumbing and sewerage.

2) Heating, piping, refrigeration, and automatic temperature control systems.

3) Ventilating and distribution systems for conditioned air.

4) Electrical installations.

An eight-page brochure spelling out the evils of bid shopping, bid peddling, and broker contractors has been prepared and distributed to over 600 architects who are members of the Chicago chapter of American Institute of Architects. In addition, copies have been mailed to 70 consulting mechanical engineers located in Chicago and to more than 80 owners of large structures, including both office buildings and manufacturing plants.

Give Reasons for Adoption

In introducing reasons for adoption of the Chicago Plan, the brochure points out how present methods of accepting and selecting bids are outmoded. The brochure states:

"Many years ago, when the mechanical specialty work represented only a small portion of the total cost of a building, all plumbing, heating, ventilating, and electrical installations were included in one over-all 'construction' contract, with one prime contractor. This single contractor, who came to be known as the 'general contractor,' would then let individual 'sub-contracts' for the mechanical specialty work.

"This was a logical procedure in those days, in view of the relative unimportance of the mechanical work. Today, with the cost of mechanical work equal to, or exceeding, that of the structural contract, this process is neither logical nor defensible."

Increased Status Substantiated

To substantiate this claim, it is shown that "the present status of the contracting phase of building construction has evolved slowly over the years, and it has kept pace with the growing complexity and cost of the mechanical portions of a building.

"That there has been such growth can be readily observed. Air conditioning, automatic controls, improved lighting, constant temperature devices and more elaborate plumbing are now commonplace in even the most conventional type of building.

"At the same time, the proportionate cost of the mechanical and electrical work has increased from what was once 10 percent or 15 percent of the cost of the building to the present level, which ranges from 40 to 70 percent of the total cost.

Bidding Practices Unchanged

"In this process of change and evolution, during which all other elements of the industry have kept pace with reality, one element — the system of bidding — has, in far too many instances, remained unchanged. This applies with equal emphasis to the related method of letting contracts."

To show how outmoded procedures work to the disadvantage of the building owner, the committee says, "Present methods in use have produced a long chain of undesirable effects, three of which are capable of bringing about a state of complete chaos in the building construction industry. These three factors are 'unreasonable cost,' 'bid shopping,' and 'bid peddling.'

Add "Handling Charge"

"Unreasonable cost results from the fact that it is deemed necessary and proper for a prime contractor to add a 'handling charge' to the cost of each of the sub-contracts which he must negotiate.

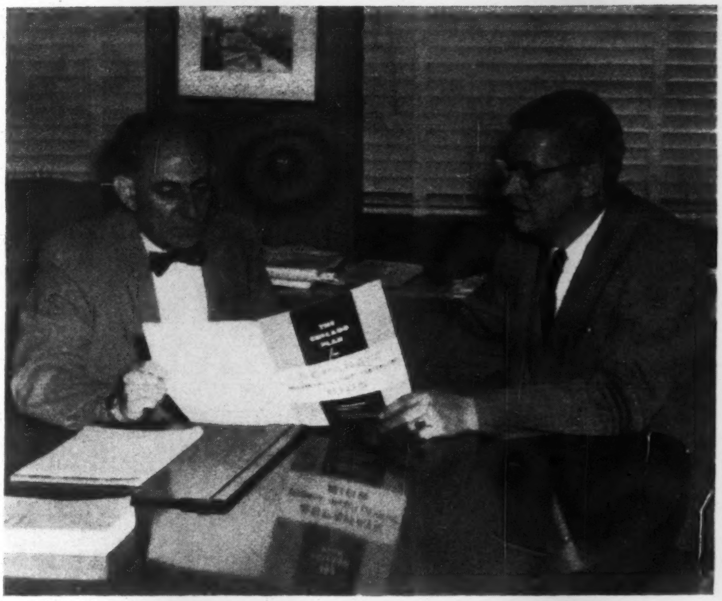
"When 50 percent or more of the total cost of a building is subject to this surcharge, in addition to a justifiable coordinating and supervising fee, it represents a sizable expense for which the owner receives nothing in return. The owner is actually paying for additional administrative paper work which detracts from, rather than adds to, the effective and expeditious completion of the building."

When a prime contractor is awarded a single contract embracing both the structural and the mechanical portions of a building,

The need for separate bids is recognized, not only by the associations which are represented on the Coordinating Committee, but by many other groups and individuals as well.

In a survey which the Coordinating Committee conducted in November of 1958, it was learned that 71 percent of the architects in the Chicago area favor separate bids.

The fact that questionnaires were returned by an extraordinary 48 percent of those to whom they had been mailed, and the additional fact that nearly one-half of those replying added their own comments, provides convincing evidence that the problem of bidding procedures is of real concern to the members of the architectural profession.



BROCHURE explaining objectives and recommendations embraced by new "Chicago Plan" is presented to R. J. Salinger, chief air conditioning and ventilating engineer, Naess and Murphy, by H. J. Couch, secretary of the coordinating committee, Mechanical Specialty Contractors' Associations of Chicago

he is prepared, as a specialist, to execute approximately one-half of his contract, namely the structural half.

Bid Shopping Is Costly

If the total amount of this single contract is, for example, $10,000,000, the single contractor is now in a position to auction off at least 50 percent of the total or $5,000,000 worth of mechanical specialty contracts.

Every dollar that is saved as a result of this auction, accrues solely to the prime contractor. Not one nickel of it goes back to the owner. This is bid shopping.

The fact that it occurs is no longer disputed. It has been condemned and disavowed by every code of ethical conduct of every contractors' group in the industry, including general contractors. It has been the subject of debate in the Congress of the United States, in state legislatures and in municipal councils from coast to coast. Still it continues to flourish, and it will continue just as long as the single contract system of bidding persists.

Efforts of general contractors who are neither builders nor mechanical specialty contractors (known as broker-contractors) and who make it a practice to auction work to subcontractors are aided and abetted by the type of mechanical specialty contractor who is willing and anxious to sell his services at any figure, no matter how low. This procedure is known as "bid peddling."

Bidder May Profit Wrongly

The bid peddler gambles that he is sharp enough to make a profit by providing inferior workmanship and by substituting inferior materials.

That he is often successful in this procedure has been learned at the expense of many a frustrated and disillusioned owner. Unfortunately, the results usually become apparent only after the building has been completed and it is too late for action or redress.

Earlier Solutions Failed

Several solutions to this problem have been tried and have been found to be entirely ineffectual. For example:

Bid listing, under which the general contractor identifies his subcontractors in advance, was first introduced. The only visible effect was a shortening of the bid shopping and bid peddling time.

Bid depositories, which establish a central location for the handling of mechanical specialty bids, were then tried. They have not been universally successful simply because they are, and must be, purely voluntary — and thus unenforceable. Any contractor is free to ignore the bid depository any time that it appears advantageous for him to do so. Many do ignore it.

Separate Bid Cures Ills

In spelling out the advantages recommended by the "Chicago Plan," the brochure states, "The complete answer to 'Unreasonable Cost' and the twin evils of 'Bid Shopping' and 'Bid Peddling' does exist, and where applied it has proven to be completely effectual.

"The procedure based on separate bids will accomplish this objective. Under this system, each of the mechanical specialty contractor groups submit separate bids directly to the owner — or to his representative, the architect, or consulting engineer — on the

a new idea in bidding

basis of separate specifications covering their particular category of mechanical specialty work.

"At no time, prior to the opening date, does any bidder get to see his competitor's bid, and at no time, after the opening, can he offer to reduce his original bid. By the same token, he is not at any time requested to meet the lower bid, real or imaginary, of a competitor. In addition, and equally important, no intermediate contractor adds to his bid an unspecified carrying charge.

Experience Shows Results

"On the basis of extensive experience with this system, it can be stated unequivocally that it produces two highly satisfactory results:

1) Costs have been lowered. On innumerable projects, under which bids were taken both ways, i.e. separately and combined, the cost of separate bids has been lower in virtually every instance.

2) Bid shopping and bid peddling have been eliminated. The low bidder, if qualified, is awarded a separate contract at the price shown in his bid. As a consequence, he is not obligated to cheapen the job in order to make a legitimate profit. The owner gets what he pays for — and at a lower price.

Plan Allows Selectivity

"In addition to the above, separate bids provide the further advantage of selectivity. As mechanical specialty work grows more complex, the selection of competent, qualified mechanical specialty contractors becomes increasingly important. When mechanical contracts are awarded by a general contractor, the owner abdicates his right to screen, through the architect, the various mechanical specialty contract bidders.

"It is inevitable that the general contractor would be influenced very strongly by price alone, and this often works to the owner's ultimate disadvantage. The architect and engineer, if they are at all competent, must consider many other factors including the experience, integrity and shop facilities of each bidder."

Variation Permissable

In some instances, it may be preferable to place all coordination and supervision under the general contractor. In these cases, it is recommended that, after mechanical contracts have been awarded, they be assigned to the general contractor.

This procedure is quite simple and is described in the "Handbook of Architectural Practice" published by the American Institute of Architects.

In the event that assignment is contemplated, the original specification and bid form would provide for a supervision-coordination fee. This would be paid to the general contractor if mechanical contracts are assigned, and it would represent a known expenditure, for a specific service.

This procedure thus offers the additional advantage of defining the amount of the supervision and coordination fee. It also prevents any contention on the part of the general contractor, as is now so frequently the case, that he is not being properly reimbursed for this service.

Payments Should Be Direct

In addition, and as a further incentive to established, solvent general contractors, the assignment of contracts should by all means include a provision for payments to be made directly to all mechanical contractors.

Frequently, general contractors in financial distress have delayed passing on the just payments due mechanical specialty contractors and have, instead, used this money to finance their own operations. Discouraging this practice will work very much to the owner's advantage.

As far as there can be learned, there are now nine states with separate bid laws relating to work performed for state agencies. These are: New York, Pennsylvania, Ohio, North Carolina, Wisconsin, New Jersey, Illinois, Massachusetts and California.

Additional support for separate bids has been given by architects in the Chicago area. (71 percent favor separate bids).

More Information Available

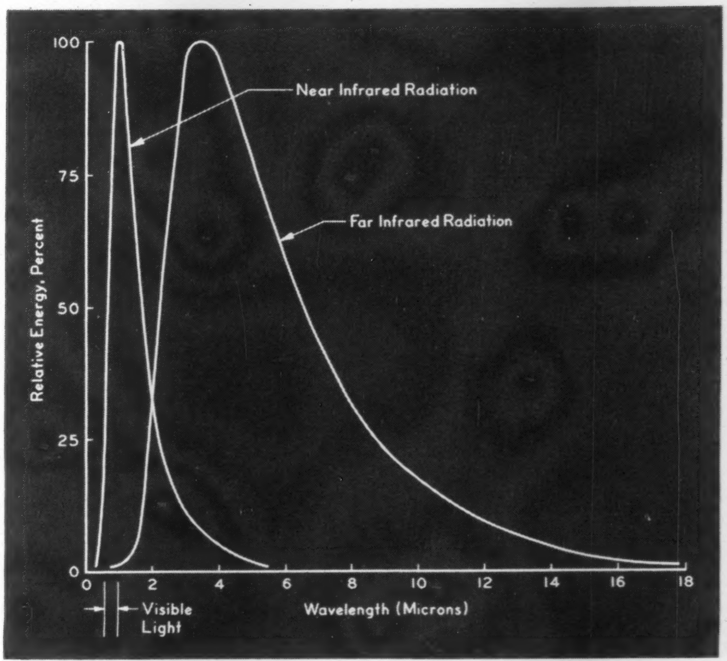
Further information about the Chicago Plan may be obtained from Henry J. Couch, secretary, Coordinating Committee of Mechanical Specialty Contractors Associations of Chicago, Room 1612, 228 N. La Salle St., Chicago 1. ‡

The Illinois Separate Bid Law was submitted during the early summer of 1959, to the Legislature of the State of Illinois.

After public hearings, and after careful analysis, an amendment to "The Purchases Act of the State of Illinois" was introduced as House Bill No. 1019.

It was subsequently approved by both the House and the Senate, and on July 24, 1959, was signed by the Governor of the State.

1 RADIATING EFFICIENCIES of two energy sources relative to the respective wave lengths of energy emitted are shown at right. Table 1 compares other characteristics of three energy-source devices used for radiant heating applications



What Do We Know About Infrared Comfort Heating?

By R. L. BOYD
Product Manager
Commercial Comfort
Heating Division
Edwin L. Wiegand Co.

• **Infrared heating devices are finding wider acceptance for commercial and industrial comfort heating applications. Some over-enthusiastic claims for the effectiveness of such installations pose a danger of dissatisfied workers and unexpected power expenses. The accompanying article presents a comprehensive review of what we know about infrared comfort heating by quartz lamps and tubes and metal sheathed heaters, and perhaps more importantly what we *think* we know; i.e. those circumstances of position, movement, dress, wind conditions, and others, which cannot be so accurately measured but which can seriously affect the adequate operation of an infrared installation. A method of determining "watts input density" based on the amount of radiation delivered to a surface is also suggested.**

WITH THE increased use and general acceptance of electrical comfort heating for commercial and industrial spaces, infrared radiant heating devices are moving from the paint baking oven and other industrial uses to comfort heating. The move has "caught on" with tremendous enthusiasm, fanned by spectacular reports of success of installations for heating sidewalk areas in front of department store show windows, drive-in bank stations, theater marquees, etc.

These publicity releases have frequently led to

Infrared Comfort Heating

unwarranted conclusions and misunderstanding. Unauthoritative statements and application guides have appeared, leading to misapplication, disappointment and customer dissatisfaction with this promising electric heating tool. Enthusiastic publicity releases have built up an "answer to everything" impression that can boomrang when results fail to meet expectations.

It does, therefore, seem timely for a review of what we know, of what is reasonably well assured, and what needs to be approached with caution until more is known, in this interesting and fast-moving field. This article will be confined entirely to consideration of electric radiant heating by quartz lamps, quartz tubes, or metal sheathed heaters. Reference data on the entire field of radiant comfort heating appeared in the Heating, Piping & Air Conditioning Engineering Data File in November, 1959.

Describe Metal Sheath Heater

The metal sheath heater is composed of a resistor embedded in an electrical insulating refractory within a metal tube. It is the most rugged of the three sources, standing up well against impact, vibration or splashing, and can be mounted horizontally, vertically, or at any angle between.

The response time of the metal sheath heater is about two to five minutes, permitting the use of a simple percentage input timer control to maintain any temperature from full on to full off fairly consistently because of the thermal mass storage of the element during the "off" period. At full operation the heaters emit a dull red glow, with no glare resultant even at maximum wattage.

Reduced voltage operation is not normally recommended because of the drastic reduction of radiating efficiency. Metal sheath radiant heaters are normally designed for about 50 watts per in. of 3/8 in. diameter tube, with lower intensities readily attained at sacrifice of radiant efficiency and higher intensities readily attained at sacrifice of life expectancy. A more frequent means of attaining higher intensity is by doubling up length by providing a hairpin element, which also affects space requirements and fixture design.

Quartz Tube Is Air Filled

The quartz tube consists of a coiled element within a fused quartz tube. The space inside the tube is air filled, the element being supported by the tube itself, which is capped (not sealed) by porcelain or metal terminal blocks. It stands up well against splashing, has medium resistance to vibration and low resistance to impact.

The tube's primary advantage is flexibility, being easy to match exact to heat, voltage, and length requirements. It has a quicker response time than the metal sheath heater, but with similar low luminosity, can be controlled by a simple percentage input timer with the "pulses" particularly noticeable visually only on low percentage settings.

Quartz tubes are normally designed for about 35w per in. of 3/8 in. diameter tube, with lower intensities readily attained at sacrifice of radiant efficiency and higher intensities readily attained at sacrifice of life expectancy. A more frequent means of attaining higher intensity is to increase the diameter of the tube. For example, the 1-1/2 in. tube can provide up to 125 w per in., but with the greater space requirements affecting design of the fixture.

Quartz Lamp Filled With Inert Gas

The quartz lamp consists of a coiled resistor positioned in a straight line and away from the quartz tube by round tantalum spacers. The filament is sealed into the ends of the 3/8 in. diameter quartz tube which is exhausted and filled with inert gas. Quartz lamps are normally designed for 100 w per in. of 3/8 in. diameter lamp, although special high temperature testing lamps (unsuited for continuous duty) are made at 200 w per in. Special construction is available at extra cost for the popular 100 w per in. lamp permitting operation in horizontal or vertical position, or any angle between when used in suitably ventilated fixtures.

Except for this special construction, with lamps over 500w installed vertically, the filament will collapse to one end causing the lamp to fail. The upper seal will also overheat, although proper ventilation (required on all ratings) could overcome this.

Application instructions presently refer to watts per sq ft density of installation as the criterion for use. In the absence of a more definitive measure of the heat available, this is perhaps the best that can be used. However, the following facts should be considered in connection with the application of infrared comfort heaters:

1) Radiant energy is converted to heat upon absorption by the receiving surface. The radiant efficiency of an element is the ratio of the energy radiated to the energy input. The radiant efficiency of a system (or fixture) is the ratio of the radiant energy directed where desired, to the input. The radiant efficiency of an installation is the ratio of the energy absorbed by receiving surfaces to the input.

2) The radiant efficiency of each source may be different. The higher the element temperature, the higher the radiating efficiency and the shorter the wave length generally. The wave length distribution of two energy sources is shown in Fig. 1.

3) The reflectance of reflectors varies with the type of material and design and maintenance of the reflecting surface.

4) The shape of the reflector and the relative position of the element and reflector will greatly affect the "efficiency of the fixture". A broad distribution curve and "spill radiation" may lose much of the potential value of infrared heating when heat sources are more than a few feet away from personnel being heated.

5) Lower temperature sources emit less radiant heat and more convection heat proportionately than high temperature sources. Convection heat is utilized only in increasing the ambient temperature, and this occurs usually above the "living level."

6) Color sensitivity varies. Black or dark-colored surfaces absorb more of the available radiant heat from any source regardless of the wave-length. Lighter-colored objects generally absorb less radiant heat, but this "color sensitivity" effect is reduced in the far-infrared portion of the spectrum. The importance of color sensitivity and the relative value of near and far-infrared are points of discussion among the experts. The reasons can be seen by comparing the high and low temperature sources, as in Fig. 1 and Table 2.

7) Watt density input is merely an indication of the heat available from the infra-red source, and not an accurate measure of ability to radiate heat to personnel or surroundings. The efficiency of the fixture, the radiating efficiency of the element, the receiving efficiency of the personnel (in light and/or dark colored clothing) all affect the effectiveness of the installation. At the present time, the best way to determine the actual requirement is by testing on a sample installation or by observing several installations with similar weather exposure, in company with an experienced observer and system designer.

How To Avoid "Hot Heads and Cold Feet"

The application of electric infrared comfort heating for overall space heating depending on maintenance of an ambient temperature for comfort is, in the opinion of many experienced designers, a mistake. It is quite possible. It is economically practical in first cost. However, as will be explained, it is generally economically impractical in energy consumption (operating cost) and the poorer the thermal construction of the space, the more disadvantageous this method becomes.

Since infrared comfort heating is generally proposed for uninsulated or poorly insulated buildings, its use for complete area heating is not usually attractive. Consequently, the balance of this article will emphasize the proper use of electric infrared for selected area, or "spot" heating.

Fixtures presently available for infrared comfort heating are generally adaptations of fixtures developed for close-up use such as paint drying ovens. While they are suitable for use not more than 8 to 10 ft from the area to be radiated, their wide distribution pattern and even wider "spill" radiation is not conducive to efficient utilization at greater distances. The tendency to mount them directly over the workers results in "hot heads" and "cold feet" discomfort, especially if practical low mounting heights are utilized.

A report on the correction of two unsatisfactory infrared comfort heating installations will clarify and emphasize the errors to be avoided in designing and installing infrared radiant heating systems for "spot" or area comfort.

Infrared Used in Manufacturing Plant

Case A involved a medium (about 8000 sq ft floor area) manufacturing plant in a 6900 degree day area. This L-shaped building had only 1 in. sheathing as insulation under corrugated iron sides and roof, and had three doors about 10 ft by 14 ft at each end and the corner of the L respectively. The building had numerous relatively large cracks and openings including a 5 sq ft conveyor opening to the outdoors.

Mounted about 14 ft above the floor were metal sheathed radiant heaters to provide an even distribution of radiation throughout with an input density of about 12 w per sq ft. Even operating the heaters 24 hours a day failed to maintain a comfortable ambient, and the radiant effect of the heaters was discernible only on the upturned forehead directly under the heaters. In addition to yielding inadequate influence on comfort, the energy consumption was entirely out of line with expectations.

Consideration of the problem indicated that it was out of the question to build up a tolerable ambient temperature within the limits of economically practical energy consumption. Even an inadequate system consumed far more energy than was anticipated in the original estimate (which was acknowledged to be over optimistic).

Infrared Comfort Heating

Furthermore, calculation of the load indicated that approximately three times the installed capacity would be required to build up a satisfactory ambient temperature in a reasonable warmup time. To possibly meet the estimates of energy use (and operating cost), it would obviously be necessary to alter the system so that it need not operate during unoccupied hours except to provide protection against freezing.

In addition, it would be necessary to revise the system so that even with an inside ambient as low as 40 F, satisfactory comfort would be produced by a high level of infrared radiation making up the heat loss from the body. Quite obviously, this required a higher density of radiation. Work stations were determined, and it was found that 20 stations existed, even though only about half that number of employees moved from one position to another as work passed through the various processes.

Consequently, the heaters were moved to about 8 ft above the floor, with radiation directed just below the waist of a workman within the work station limits, and from at least two sides. This resulted in about 30 to 40 w per sq ft input being concentrated on about 2700 sq ft of actual work areas, disregarding the remainder of the space. Because this level of radiation was warmer than comfortable even under relatively low ambient temperatures, cycling controllers were placed at each work station to permit local control of the heaters serving that particular work station from 100 to about 35 percent of maximum input.

This arrangement resulted in a warm enough sensation to require reduction of the input within about 20 minutes from the start of the heating system at the beginning of the day, and progressive lowering of the input as the ambient built up slightly over the working day. The result was adequate comfort for the workers, and materially reduced energy use, so that the operating cost is expected to be quite close to the estimate from here on.

The installation also used the conduit for supporting the heaters as well as for furnishing a wireway. The heaters may be turned to change the angle at which they project their radiation on the work station. The input controllers hang down within the worker's reach at each work station. Production workers are not likely to use the localized controls, however, tending to use them as on-off switches. One master input controller, adjusted by a working foreman, gives better satisfaction than the individual work station controls.

Sheet Metal Brake Presents Problem

In the case of a power brake, the sheet metal being formed would be at about waist level, and would shade the workers lower extremities from overhead infrared radiation. It was found that concentration of the heat on the lower mid-section, with some radiation down to the feet, tapering off at the exposed face and head level, resulted in the greatest degree of comfort with least energy input.

Accordingly, at the power brake, metal sheath heaters were mounted on the lower part of the legs at each side of the brake, to radiate toward the lower extremities of the worker regardless of the positioning of sheet metal being worked.

From this example, it can be seen that a building that is quite impractical to heat by raising and maintaining a tolerable ambient temperature can be heated satisfactorily for comfort with a fraction of the connected load and a small fraction of the energy use required for total area heating, by concentrating on the work areas to be occupied. This is often referred to as "people heating" or "selected area heating". This is the proper and effective application of electric infrared heating.

Production Methods Change Picture

Case B involves a manufacturing plant totalling about 17,000 sq ft of floor area designed for produc-

TABLE 1 — CHARACTERISTICS of three infrared sources

	Quartz lamp	Quartz tube	Metal sheath
Relative heat intensity	Very high	Low to medium high	Medium to high
Splash resistance	Very good	Very good	Very good
Color blindness	Fair	Very good	Very good
Life expectancy	All very good. Usually 5000 hours or more.		
Visible light	High	Low	Low
Heat up & cool down time	A few seconds	Two minutes or more	About two minutes
Relative cost/kw	Medium-high	Medium	Medium
Filament or source temperature	About 4000 F	About 1200 to 1800 F	About 1200 to 1800 F
Resistance to vibration	Medium	Medium	Very good

Source: Electrified Industry Magazine

tion area. However, it is used as about one-third production, one-third storage of sub-assemblies, and one-third storage of raw materials. The general infrared heating system was mounted about 12 ft above the floor, with fluorescent lights about 2 ft lower than the heaters. The installation provided about 10.5 w per sq ft input evenly over the entire area of a tightly built building, with 3 in. of effective insulation in batt form on walls and roof. With about 2-½ hours warm-up time, it was no problem to build up a comfortable ambient temperature of 70 F for the working hours from a 50 F night set-back temperature for unoccupied periods.

However, the estimated energy use (and consequently operating cost) for an entire winter was used up in about two months. This occurred despite management attempts to prevent it by cutting back on temperatures and on warm-up time after a month of winter operation foretold the excessive energy use.

The result of these attempts to economize on operating cost was discomfort, and, of course, employee dissatisfaction and resultant customer complaint. Here, however, the work was bench work on relatively small assemblies with the workers arranged around work tables, easily re-arranged as the nature of the work changed, but fixed in position for the duration of a given run of production.

Since the workers did not move from station to station, this installation was readily controlled by a zone input controller operating to cycle all heaters on the zone in accordance with one master setting of input. The same principle of moving the heaters to concentrate on the work areas was employed, but the same conduit mounting to enclose wiring and mount the heaters was terminated at the top in rubber cord and twist-lock plugs, to permit easy modification of the mounting location as the production work benches were moved.

Anticipate Equally Good Results

Although changes were completed just as cold weather ended, it is indicated that the result was to again eliminate need for more than a few minutes warm-up, and require progressive need for reducing the input as the ambient temperature built up in the space. Operating costs are back in line, and complaints of cold working conditions have virtually disappeared. With the onset of cold weather, further observations will be made.

These experiences indicate the desirability of development of infrared heating fixtures with a smaller included angle of irradiation, and a re-direction of "spill radiation" into the desired confined angle. This will permit higher mounting height of the fixtures to produce results similar to those described above. A higher mounting height would have been preferred in both instances. had suitable fixtures been available.

TABLE 2 — COMPARISON of low and high temperature sources of radiant heat

High Temperature (Above 2000 F)	Low Temperature (Below 2000 F)
1) Called "near-infrared"	1) Called "far-infrared"
2) Radiate over 85% of their input as infrared energy	2) Radiate no more than 60% of their input as infrared energy.
3) Less of the "near-infrared" energy is absorbed by light-colored objects	3) Available "far-infrared" more readily absorbed by light-colored objects

For dark colored subjects, the high temperature source is always more efficient than the low temperature sources. Light colored subjects might absorb less of the near-infrared despite the greater amount available, than they do the far-infrared. Where a variety of colors might exist the far-infrared gives more uniform results to all subjects regardless of color.

Air Movement Increases Heat Loss

Now, a word about wind effects. The principle of infrared comfort heating is to reduce the excessive heat loss due to low ambient temperatures by radiant heat gain on the exposed body surfaces through comfortable light clothing for in-plant work.

The effect of excessive heat loss by convection due to wind effects is another consideration. There is no doubt but that some of this excessive heat loss can be offset by radiation. With substantial air movement, however, the magnitude of this excessive heat loss is seldom realized.

Study Chilling Effect of Wind

The Army Surgeon General caused investigation of this chilling effect to be made so that troop commanders could be advised on suitable clothing to prevent injury from cold exposure to soldiers.

The results were tabulated as a Wind Chill Chart, indicating the equivalent temperature for the same rate of cooling in still air on exposed flesh for a variety of air temperatures and wind velocities. The chart is shown in Table 3.

With a 15 mph wind, and air temperature of 42.5 F, the rate of cooling on exposed hands and face, is like still air at 27 F below zero. With the same wind, even a relatively warm 55 F cools like 11 below. With this kind of effect from wind, it would certainly seem more fruitful to expend our energies on design of suitable wind-breaks in areas with significant wind influences, instead of calculating and locating radiation to attempt to overcome the effect of the wind. In fact, there are some who are not convinced that any amount of radiation will offset the cooling effect of substantial wind with temperatures below 55 F.

When electric infrared comfort heating is intelligently applied, there is no dependence on building up the ambient temperature to attain comfort. What build-up of ambient does take place is merely a by-

Infrared Comfort Heating

product (although a valuable by-product) of the system installed to irradiate personnel and selected areas normally occupied by personnel.

Any application guide based on comparative insulation values of the building is immediately suspect of having been written without understanding of the true nature of infrared heating and the proper use to be made of it. Comparative thermal values of construction will affect the energy consumption but have almost negligible influence on the capacity that should be installed.

Similarly, the arbitrary addition or deduction of a percentage of radiant density for greater or less distance in mounting height is actually an attempt to compensate for the lack of control and positive cut-off of presently available fixtures. It is believed to be highly misleading to use such a method of evaluation.

Suitable fixtures with reduced angle of distribution of radiation and positive cut-off of spill radiation are soon to be available. In the meantime, it is necessary to operate in this market, aggressively and authoritatively using the tools at hand at this time. Consequently, here are some suggestions for the intelligent application of electric infrared comfort heating in two basic parts: 1) What we know, and 2) What we are pretty sure we know:

What We Know

1) Infrared comfort heating should be applied by directing a minimum of 50 w input slightly below the waist of the workers, from at least two directions (not directly overhead), in the normal area of activity of the workers. (See Box, How To Determine Watts Input Density, page 140)

2) Control of the radiant heat must be provided to permit reduction of radiation rate as the ambient temperature increases due to build-up from the heaters or milder weather. This control may preferably be local for each work station when many more work stations than workers exist, or in those cases where workers move from one station to another.

The control may also be zone orientated with many work stations included, in which the workers remain at their station and all workers on a zone work at a similar degree of activity.

3) The quartz lamp has the greatest heat output per unit length, has an extremely rapid warm-up, is unaffected by drafts on the element, withstands splashing, radiates "near-infrared" heat and a substantial amount of visible light. Special lamps are available for vertical mounting.

4) The quartz tube has a quick warm-up, is unaffected by drafts on the element, withstands splashing, radiates "far-infrared" heat and a low level of visible light. Quartz tubes must be mounted horizontally.

5) The metal sheath heater has a slow-warm-up, stands up well against impact and vibration, must be protected against drafts, withstands splashing, radiates "far-infrared" heat and discernible visible light. It can be mounted at any angle.

6) With presently available heaters, the heaters must be within 10 ft of the personnel being heated (and should be at least 3 ft away from personnel for safety).

Guide For Determining Electric Radiant Heating Element Size

1) 50 w per sq ft from two directions (not overhead) directed just below the waist. (See Box for how to determine "input density".)

2) For assured ambient temperatures NEVER below 20 F, reduce by 1 w for each degree above 20 F to a minimum of 12 w per sq ft.

3) For mounting more than 10 ft from worker, presently available fixtures do not concentrate rays adequately and require safety factor to offset. Add 5 percent additional capacity for each foot greater than 10 ft between worker and fixture UNTIL or UNLESS more efficient fixtures are available.

Minimum ambient temperature, F	Radiant input watts per sq ft at 10 ft	Minimum ambient temperature, F	Radiant input watts per sq ft at 10 ft
20	50	45	25
25	45	50	20
30	40	55	15
35	35	60	12
40	30	over 60	12

TABLE 3 — WIND CHILL equivalent temperatures on exposed flesh at varying wind velocity

	Wind velocity (miles per hour)										
	45	35	25	20	15	10	5	3	2	1	0
Temperature, F	90	89.5	89	88.5	88	88.75	87.5	87	86	84.5	83
	82	81	80.5	80	79.5	78	76	74	72.5	70	60
	72	71	69.5	68	67	65	60	57	53.5	47.5	23
	63	61	59	57	55	52	44.5	39	34.5	20	−11
	51	49	47	45	42.5	38	28	18.5	11	0	−27
	41	39	36	34	30.5	25	11	0	−9	−23.5	−38
	30	28	25	23	18	11	−5	−16.5	−40	Below −40	Below −40
	20	18	14	11	6	−2	−19	−40	Below −40	do	do
	10	7.5	3	0	−6	−15	−35	Below −40	do	do	do
	0	−2.5	−8	−12	−18	−29	Below −40	do	do	do	do
	−11	−14	−18	−23	−30	Below −40	do	do	do	do	do
	−21	−24	−30	−35	Below −40	do	do	do	do	do	do
	−32	−35	−40	−40				do	do	do	

Instructions for use of the table:

1) First obtain the temperature and wind velocity forecast data.
2) Locate the number at the top corresponding to the expected wind speed (or the number closest to this).
3) Read down this column until the number corresponding to the expected temperature (or the number closest to this) is reached.
4) From this point follow across to the right on the same line until the last number is reached under the column marked zero (0) wind speed.
5) This is the equivalent temperature reading. Example: weather information gives the expected temperature (at a given time, such as midnight) to be 35 F. and the expected wind speed (at the same time, midnight) to be 20 miles per hour (mph). Locate the 20 mph column at the top, follow down this column to the number nearest to 35 F. The nearest number is 34 F. From this point, move all the way to the right on the same line and find the last number, which is −38 F. This means that with a temperature of 35 F. and a windspeed of 20 mph the rate of cooling of all exposed flesh is the same as −38° F. with no wind.

Reproduced by permission of the Department of the Army.

What We Think We Know

7) Design attention to wind-breaks is more fruitful than over sizing to overcome the cooling effect of wind or heavy drafts.

8) The 50 w per sq ft basic design criterion can be reduced by 1 w per sq ft input radiation for each degree above 20 F ambient temperatures (with no drafts) that can be assured as a minimum operating ambient at any time, to a minimum density of 12 w per sq ft.

For example, if 40 F is the lowest ambient anticipated (by weather records or any freeze protection operation of the heaters), a level of 30 w per sq ft will be adequate; but for a 60 F ambient, the minimum of 12 w will govern rather than the 10 w by the rule.

In the event infrared is used for overall space heating of an entire area, the density can be reduced so that the total installed capacity equals the calculated heat loss of the space.

9) For light colored clothing the greater absorption of "far-infrared" heat from quartz tube and metal sheath elements substantially offsets the more efficient production of "near-infrared" heat by quartz lamps. For dark colored clothing, the quartz lamp is likely to be more efficient than quartz tube or metal sheath sources.

10) The absorption of infrared by dust, carbon dioxide and other air or air borne substances does not decrease the radiation enough to revise calculations for mounting distances under 50 ft. The drop-off of radiant energy due to distance is substantially the same for quartz lamps, quartz tubes and metal sheath elements, and is more a function of fixture design than element source of wavelength or radiation.

11) Intelligent design will be hampered until a simple, inexpensive and accurate instrument for measuring the radiant energy effectively directed on the area is available.

12) Wind effects can completely upset the comfort levels anticipated and with significant wind effect, no amount of radiation necessarily produces comfort.

13) It is more difficult to produce comfort with infrared heat directly on heavily clothed personnel than on moderately or lightly clothed personnel. Clothing is insulation. It retards heat transfer from the body to cold ambients, which is why we dress more heavily in cold weather. It similarly retards radiation, converted to heat at the surface of the clothing, from being "felt" for a considerable period after initial exposure to the radiation. ‡

See "How To Determine Watts Input Density," page 140

How To Determine Watts Input Density

UNTIL suitable instruments are available to measure radiation delivered to a surface, the following method of determining "watts input density" is suggested:

1) Determine the included angle of radiation designed into the fixture to be used. Typical of fixtures presently available is an included angle of 60 degrees.

2) Based on the included angle and the distance between the fixture and the target to be heated, determine the width of radiation pattern from the fixture. For example, for a 60 degree fixture, the width of radiation pattern is indicated in Fig. 2, along with additional data.

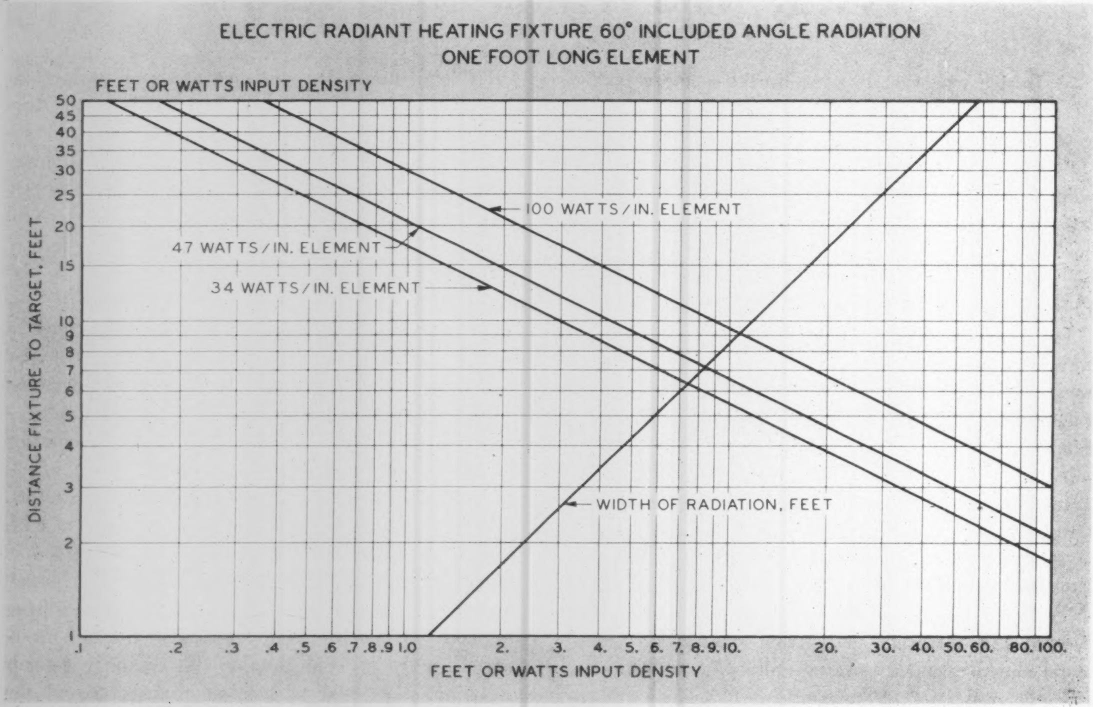
3) For the tentative mounting location, determine the area of the radiation pattern. The length of the radiation pattern is substantially the width plus the fixture length. As a practical matter, if the radiation area is considered to be a square, the error introduced at practical mounting distances is negligible. Therefore, Fig. 2 is based on the area of a square pattern, using the calculated width. This means that if the element length is doubled, the radiation received is doubled; if the element is trebled, the radiation is trebled; quadrupled, quadrupled, etc. This principle applies so long as the distance from fixture to target is at least five times the total element length.

4) For the distance and area involved, the watts input density can be read from Fig. 2 for one foot of heated element length of appropriate element density. Dividing this density read from the chart into the design watt input density required for the job will indicate the number of ft of heated length required from all fixtures radiating the area. Select fixtures (usually two per work station) to provide the necessary total element length.

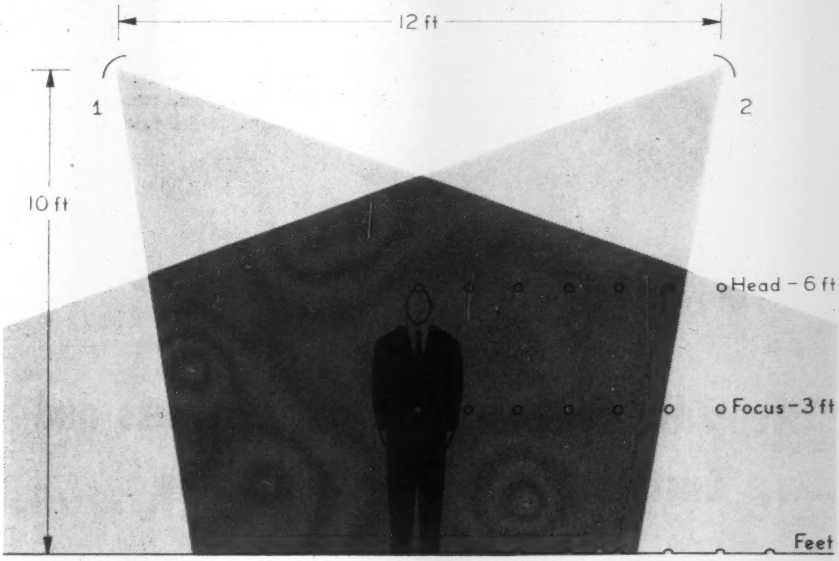
5) Similarly, for a given installation, knowing the distance and fixture details for the installation, determine the watt input density per ft of element from the chart for the location concerned. Multiplying this value by the ft of element radiating the location concerned gives the total watt input density.

6) In the event fixtures are mounted at different distances from the focus, determine the watt input density from each fixture. Adding them together will indicate the total watt input density to be experienced.

7) Knowing the fixtures to be used and the watt input density required, the distances between fixtures and target can be determined to finalize mounting location; or knowing the fixtures to be used, the watt input density for various mounting positions can be determined.



2 RADIATION PATTERN width, in ft, for 60 deg electric radiant heating fixture can be determined from graph, above. Watts input density per sq ft and required heating fixture length can also be determined, as explained in text



3 **TYPICAL ELECTRIC** radiant comfort heating for work station where worker may move within a 6 ft x 4 ft area

Fig. 3 indicates a typical electric comfort heating installation designed for a work station where the worker may move within a 6 ft by 4 ft area. The space is to be held to a minimum temperature of 40 F for freeze protection, whether occupied or not. Therefore, the minimum ambient temperature to be experienced is 40 F, requiring 30 w input density for comfort (according to guide table).

Two fixtures are mounted 12 ft apart, 10 ft above the floor, centered on the work area, each fixture parallel to the short dimension of the work area and 6 ft from the centerline in the middle of the long dimension.

Metal sheath radiant heaters with 38-½ in. heated length each are controlled by a timer, an input controller, and two limit thermostats, one energizing the system if the temperature falls below 40 F when the timer has it off for unoccupied periods, the other de-energizing the system if the ambient temperature goes up to its setting (usually about 65 F).

The design provides for 32 watts density input directed just below the waist of the worker at the center of the work station, (5.0 w per ft of length from each fixture). Table 4 indicates the watts input density at the head (6 ft above the floor) focus, (3 ft above the floor) and feet, (at the floor), for the center of the work station, and for each ft from the center along a center line parallel to the long dimension. It indicates a comfortable distribution 3 ft from the center, satisfactory comfort (with warm head and cool feet) for another ft, then cold feet and focus and unsatisfactory head comfort beyond that 5 ft point. This gives a good comfort condition for a work station about 6 ft x 9 ft and satisfactory comfort for a work station 8 ft x 9 ft.

Study of the illustration and table will indicate the desirability of:

1) Additional sources to achieve a better balance between head, focus and foot density of radiation. Sources close to the floor are required to accomplish this, but practical installation limitations frequently prohibit such locations.

2) A more narrow included angle of radiation would permit a pattern of radiation (at this work station) similar to the example, with the fixtures much farther away. This would minimize the rapid increase and decrease in irradiation received as the worker moved about within and adjacent to the work station.

TABLE 4 — WATTS INPUT DENSITY, using 47 w per in. element, 1 ft long

Location	Fixture No. 1			Fixture No. 2			Total		
	Head	Focus	Feet	Head	Focus	Feet	Head	Focus	Feet
Center	7.5	5.0	3.2	7.5	5.0	3.1	15.0	10.0	6.3
1 ft from center	6.2	4.4	2.8	9.3	5.8	3.4	15.5	10.2	6.2
2 ft	5.0	3.8	2.5	11.7	6.4	3.6	16.7	10.2	6.1
3 ft (End of Work Station)	4.2	3.2	2.3	15.0	7.4	3.9	19.2	10.6	6.2
4 ft	3.5	2.7	2.1	17.0	8.2	4.1	20.5	10.9	6.2
5 ft	3.0	2.4	1.9	19.5	0	0	22.5	2.4	1.9
6 ft	2.5	2.2	1.8	0	0	0	2.5	2.2	1.8
7 ft	0	1.9	1.7	0	0	0	0	1.9	1.7

Note that although a work station only 6′ x 4′ was the problem to be solved, because of limitations of practical mounting height and available fixtures, a considerably more extensive area had to be irradiated. A pattern about 9 ft wide is produced by each fixture, and arranged for satisfactory overlap from both at, and near the center of the work area, excellent distribution results for the central 6 ft and satisfactory comfort for 8 ft of this 9 ft path.

Although the head gets warmer one ft farther (than 4) from the center, the focus and feet lose all the radiation from the nearest heater, and get comparatively cold. Further movement from the center gets the head out of range of radiation.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally on practical problems in the field.

Sam Lewis says:

"Keep Up With Engineering Progress and Customs on the European Side"

IT IS INTERESTING to keep up, as far as practicable, with engineering progress and customs on the European side, and to note some of the different ways they have of expressing our engineering terms. For instance, they are accustomed to designing hot water heating systems with a temperature differential of 35 F, as compared to our conventional differential of 20 F.

I used to be told that they had forgotten many things about heating by mechanically circulated hot water, before we even commenced seriously to adopt it.

When we extend long welded steel pipes underground in district heating, we must care for longitudinal expansion and contraction. We specify expansion joints, with anchors.

European engineers prefer an anchor to restrain a boat at sea, and so our anchor becomes to them a "fixed point". Over there, our expansion joint becomes, more elegantly, a "compensator".

We call the valuable duty of a mechanical entity, the *output*, but they call it an "offtake". Often we are a little confused by the term expansion tank and by the same physical appliance being called a compression tank. They call the same unit a "buffer tank" which certainly pleases me. We may call a throttling appliance in a pipe a reducing valve. They call it a "recession valve", which to my mind is somewhat less apt than our term.

The heat disposal point of an air conditioning plant, by which we may mean a cooling tower, to them is better expressed as the heat "rejection" point.

We like to achieve improved economy and better control of temperature in an accelerated water heating or cooling plant, by judiciously controlled mixing of a portion of the recirculated liquid from heat transfer systems with a portion of new liquid; which may come warmer from the heater or cooler from the chiller. We may use a three-way valve, where the new No. 1 liquid joins the returning No. 2 liquid, on the journey to the heat transfer apparatus.

The European three-way valve is a "mixing tube" which apparently must have at least a valve for No. 1 and a second valve for No. 2 and perhaps a third valve for No. 3; probably costing more than our single three-way trick. They do like to have their mixing tube of comparatively large diameter, so that the No. 3 liquid is perhaps a better blend than results when our three-way valve is not deliberate in its genuflections.

The Netherlands have a public spirited engineering group, (said not to be for profit), to promote efficiency in mechanical plant operation. This organization is called *Krachtwerktuigen*. They call it "KW" because, like Voostenwalbert Schimmelpennig of Hans Brinker, "the monkey with the long name for a tail", they borrowed the Greek electrical Kilowatt. Their KW term is likely to be confusing to us.

They enlarge on a heat pump with a little glamour. The warm Saturday night waste bath water, and warm meal-time waste dish water, may be conserved in a large tank from which the water ultimately overflows to the sewer. A power-driven compressor for a refrigerant has its condenser coils exposed in a second tank to the entering city water for the building and may warm this entering water to a small extent.

The refrigerant from this compressor is expanded in coils within tank No. 3, containing the circulating water on its way to the rooms. This heat pump is said to attain a coefficient of performance up to 4 or even 4.17! ‡

New Graph Relates Thermo-Physical Properties of Saturated Water, Steam

By J. S. HUCKS
Plant Design Engineer
Nuclear Division
Combustion Engineering, Inc.

THE DATA conveyed by the following curves, relating to thermo-physical properties of saturated water, have been assembled over a period of years during the course of work on heat transfer and fluid mechanics for nuclear reactor systems design.

The curves relate various properties of saturated water to temperature in degrees F. The relationships established are specific heat, thermal conductivity, electrical conductivity, absolute viscosity, Prandtl No. and specific volume — all for saturated water.

The electrical conductivity curve for chemically pure water has been found of value as a result of steam sampling work in which sample cooler conditions are often not adequate for cooling to the 25 C level.

The specific volume of saturated steam recurs frequently in calculations in this area and has been included for that reason. If it were eliminated, the entire set of curves would be applicable to saturated water only.

All the dimensions represented here are consistent, and are such that values may be entered directly into the numerous correlations utilized to determine convection heat transfer coefficients and/or any of the other empirical equations encountered in heat transfer analysis.

This information is classical and can be obtained, with appropriate time and patience, from a variety of sources. The references listed below constitute only a few of the many possible sources which are available. Each reference is followed by a list of the saturated water or steam properties which may be found therein. ⌗

References

1) R. O. Parker and R. J. Zioboro, Comments on Corrections to Steam Conductivity Measurements, American Society for Testing Materials Special Technical Pub. No. 192. (Electrical Conductivity)

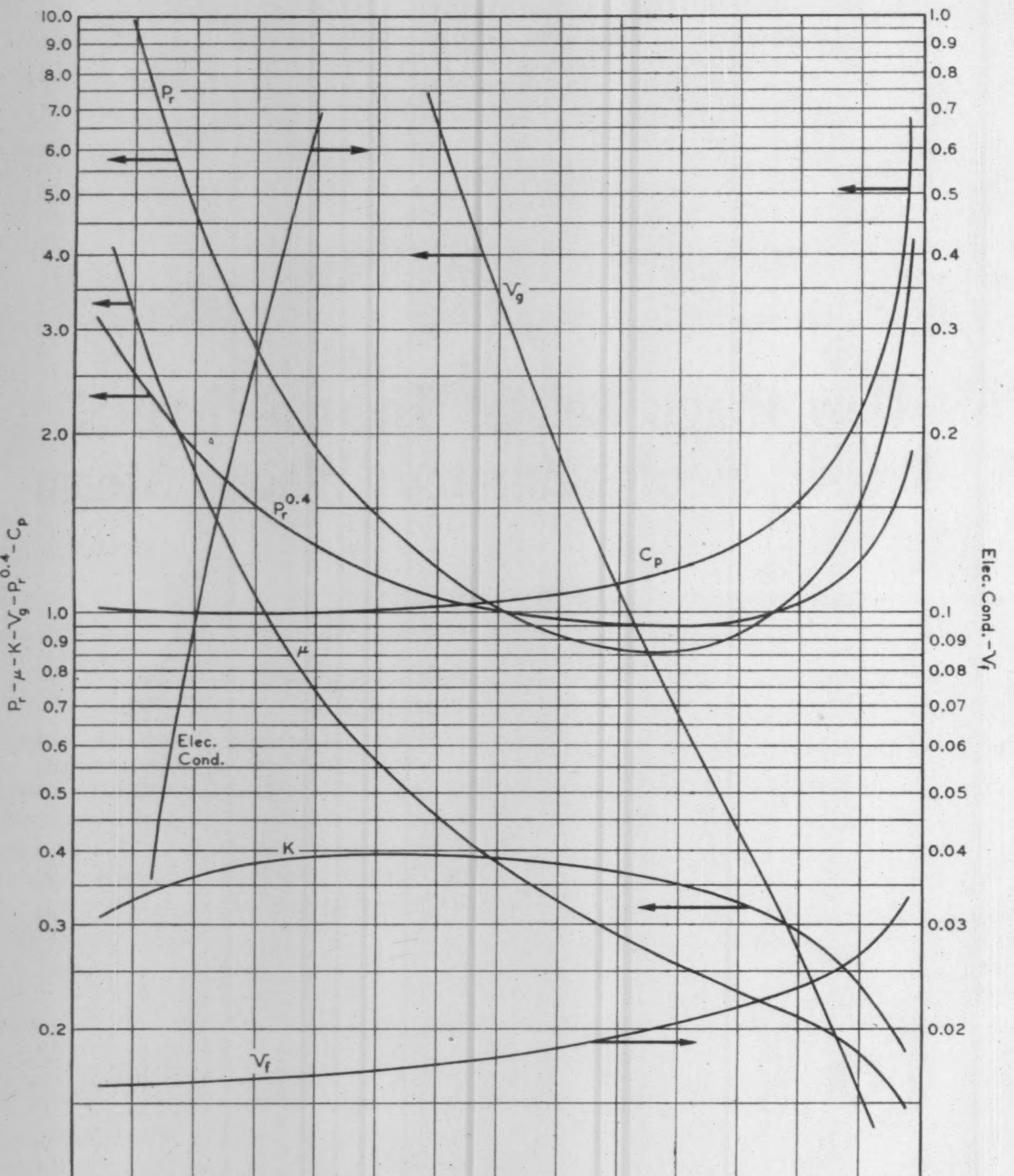
2) J. H. Keenan and F. G. Keyes, Thermodynamic Properties of Steam. First Ed. 1957, John Wiley and Sons, New York. (v_f, v_g)

3) N. Ernest Dorsey, Properties of Ordinary Water — Substance. 1953, Reinhold Publishing Corp., New York. (μ)

4) E. J. Wellman, A Survey of the Thermodynamic and Physical Properties of Water — M. S. Thesis. (μ, K, C_p P_r)

5) A. I. Brown and S. M. Marco, Introduction to Heat Transfer. 1951, McGraw Hill Book Co., Inc., New York. (μ, K, C_p)

HPAC DATA SHEET



THERMAL CONDUCTIVITY, Electric conductivity, specific volume, Prandtl No., absolute viscosity, specific heat, and Prandtl No. to the 0.4th power for saturated water plus the specific volume of saturated steam are related to temperature (F) in the graph above. The table below defines symbols used for various curves

P_r = Prandtl No. = $\mu cp/K$
C_p = Specific heat = Btu/(lb) (F)
K = Thermal conductivity = Btu/(hr) (sq ft) (F/ft)
μ = Absolute viscosity = lb/(hr) (ft)
Elec. Cond. = Electric conductivity pure water = micro mhos/cm
v_f = Specific volume, saturated water = cu ft/lb
v_g = Specific volume, saturated steam = cu ft/lb

How to match

Centrifugal Pump Needs And Bronze Alloys

for process piping

By HAROLD W. WOODHOUSE
Chief Engineer
Dean Hill Corp.

• The multitude of bronze alloys available to the modern commercial-industrial user may be alternately a blessing and a problem. The accompanying article can serve as a base for bronze alloy selection and use, specifically as related to the selection of centrifugal pumps for a wide variety of process piping requirements. The major alloys are explained, with comments on some metallurgical problems in application.

Mr. Woodhouse was educated in England and has been associated in engineering design with various domestic firms in the heating, piping and air conditioning field. He is a member of the API committees on mechanical drive turbines, centrifugal compressors, and pumps.

In this modern age of myriad alloys there is no group of alloys more plentifully supplied with subtle variations in composition than the bronzes.

The too wide choice of bronzes frequently presents a problem to the mechanical, chemical, petrochemical or pump engineer who is required to specify the grade to be used.

In the remote, medieval engineering past of, say, fifty years ago, the engineer was limited, pretty much, to specifying materials as being either iron, steel, brass or bronze.

There were few alloys and special treatments. When an engineer wanted to emphasize that he would like a good iron casting he would specify "cylinder metal" — that being a close grain cast iron then in common use for the big reciprocating engine cylinders of the time. Manganese bronze had come into use for ship's propellers. Nowadays one could easily compile a list of 20,000 different ferrous and non-ferrous alloys.

What is bronze? What is brass? Basically, each has copper as its major ingredient with tin as an alloy for bronze and zinc for brass.

Types Multiply Quickly

From this starting point one can proceed to the selection of the particular variation most suited to the application. For specific industries there is the choice of architectural bronze, coinage bronze, hardware bronze, instrument bronze, medal bronze, statuary bronze and optical bronze as samples.

In broad categories there are also: aluminum bronze, lead bronze, phosphor bronze, manganese bronze, nickel bronze, vanadium bronze, hard bronze, Naval bronze; with each of these sub-divided into numerous variations.

centrifugal pumps and the bronzes

In the absence of specific field operational experience it would not be rare for a user to purchase several centrifugal pumps identical in all respects except materials so that material failures might be compared under identical operating conditions. This might include two or more types of bronzes. While there are many bronzes from which to select there is an infinitely greater number of liquids and conditions with which a centrifugal pump has to contend and often a customer (and pump manufacturer) has had no prior experience with the particular set of conditions faced.

Particular Alloys Sometimes Avoided

Sometimes a particular bronze is required, not for what it contains but for what it does not. The chief examples of this to be met in centrifugal pump use will be where a bronze must either be lead or zinc free.

The following are common alloying elements used with bronze:

Zinc, in spite of the basic definitions of brass and bronze, is frequently used in bronzes where its effect is to add strength and corrosion resistance to the copper.

Tin is used in bronze in amounts ranging from 5 to 20 percent. Its effect is to strengthen and harden the copper, making it tougher and more wear resistant.

Lead is added up to 35 percent for automotive bearings. In amounts of 5 to 25 percent it improves machinability. Combined with tin as an alloy it improves the antifriction qualities.

Aluminum is the base of a series of high strength alloys.

Iron is added to the silicon, aluminum and manganese bronzes for strength and wear resistance.

Phosphorus is added principally as a deoxidizer. In greater amounts it improves hardness and wear resistance.

Nickel refines the grain and toughens the alloy. It improves strength, corrosion resistance and whitens the alloy. Longer life is claimed for nickel-aluminum bronze ship's propellers over the older manganese bronze.

Silicon bronze alloys have high corrosion resistance, high strength and toughness.

Beryllium bronzes form an age-hardening group and they are the strongest of the copper alloys. They can present problems in machining not common to the other bronzes.

Manganese is used to produce a high strength alloy. It has a long history in marine applications.

While there are many ramifications to the subject the present article attempts only to consider a few salient facts relating to the bronzes and their use and non-use in centrifugal pumps.

List Available Bronze Alloys

Table 2 is a convenient reference list of some of the bronzes made by American manufacturers. Some discretion must be exercised in its use. Local availability may be important. A hard bronze available only in bar stock would be useful for shaft sleeves but not pump casings.

Metallurgical problems relating to bronzes and their application in centrifugal pumps might be broken down into the following broad categories:

1) Applications where almost any kind of bronze is considered satisfactory.

2) Where bronzes are undesirable because of the chemical or electrolytic action set up.

3) Where bronzes are acceptable provided certain elements are absent.

4) Where bronzes are unacceptable because of their susceptibility to erosion.

Industrial Pumps Use Bronze

The standard type of industrial pump is generally bronze fitted. This means that the impeller, impeller wearing rings, case wearing rings and shaft sleeves are bronze. This is the pump of category (1). This does not necessarily mean that in all instances the bronze in a standard fitted pump is unaffected by its operating medium.

Sometimes a material, or materials, which would be completely impervious to a particular medium would be so expensive it would be considered more economical to replace at intervals the most affected parts.

Occasionally, a bronze impeller is replaced by another, harder, ferrous material because of excessive erosion resulting from cavitation, which is purely a mechanical impact in its effect on the impeller. Using a harder material will lengthen the life of the impeller but the proper solution in such instances is to correct the flow conditions on the suction side of the pump.

Brine Causes Galvanic Action

In category (2) the most common example to be met is a pump handling sea water or brine. In the standard bronze fitted pump if used in such service there is a combination sea water, cast iron and bronze. The result is that a galvanic action is set up.

Table 1 is a tabulation of metals arranged as a galvanic series in decreasing order of potential as measured in sea water.

This galvanic table shows that cast iron and carbon steel rank higher in the series, in the presence of sea water, than such alloys as the yellow, aluminum or Admiralty brasses or "G" bronze. The result, with a bronze fitted pump, is an electrolytic action takes place which converts the cast iron casing interior surface into a mixture of graphite and iron oxide. This takes place most actively where the water velocity is highest. The process is known as graphitization.

The graphitized layer becomes increasingly impervious to the penetration of the water as its depth increases. The rate of attack on the underlying cast iron base is correspondingly reduced.

If, at certain points in the liquid flow the velocity or impact is sufficiently high to keep the graphitized layer washed away, the cast iron will be continuously exposed and this can lead to local failure of the casing.

It is for this reason that most pump users in this type of application request that the pump manufacturer, at the time the pump is purchased, specify a "retiring" thickness. In other words, when the casing wall has decreased in operation to the retiring thickness the casing must be scrapped and replaced.

The approach to the problem depends to a large extent on the initial cost limitation. Some will take a standard bronze fitted pump and replace worn parts periodically.

The electrolytic action can be reduced by using an all iron or all bronze pump. More costly solutions are to use monel or stainless steel in place of bronze. One recommendation for a compromise between optimum life and minimum cost is a 1 to 2 percent nickel cast iron casing, S monel impeller and impeller rings, Ni-Resist Type 2 case wearing rings, aged K monel shaft and shaft sleeves.

TABLE 1. — GALVANIC SERIES for various metals arranged in decreasing order of potential as measured in sea water

	Volts
Magnesium (H Alloy)	1.48
Zinc	1.03
Aluminum (Alclad 3 S)	0.94
Aluminum 52 S-H	0.74
Cast Iron	0.61
Carbon Steel	0.61
Stainless Steel. Type 430	0.57
Ni-Resist Cast Iron	0.54
Yellow Brass	0.36
Aluminum Brass	0.32
Composition 'G' Bronze (88-10-2)	0.31
Admiralty Brass	0.29
70/30 Cupro Nickel (0.47% Fe.)	0.25
Nickel	0.20
Stainless Steel. Type 316	0.18
Inconel	0.17
Stainless Steel. Type 410	0.15
Titanium (Commercial)	0.15
Silver	0.13
Stainless Steel. Type 304	0.08
Hastelloy 'C'	0.08
Monel	0.08

The following is a partial list of liquids for which standard bronze fitted pumps are *not* recommended and for which an all iron pump is usually supplied:

Acetaldehyde
Ammonia, Aqua
Ammonium Bicarbonate
Carbon Bisulfide
Enamel
Lime Water (Milk of Lime)
Lithium Chloride
Methyl Chloride
Miscella (20% Soybean Oil and Solvent)
Potassium Bichromate
Potassium Carbonate
Soap Liquor
Soda Ash (Cold)
Sodium Phosphate: Tribasic
Sodium Plumbite
Sulphur — Molten

Liquids Also Harmful

There are a great many liquids for which bronze is not recommended and one of a series of special alloys is necessary. Some of these are:

Acetic Acid (Vinegar)
Chromic Acid
Formic Acid
Hydrochloric Acid
Nitric Acid
Sulfuric Acid
Aluminum Sulphate
Brine, Sodium Chloride (Over 3% Salt, Hot)
Calcium Chlorate
Copper Nitrate
Copper Sulfate
Hydrogen Peroxide
Hydrogen Sulfide
Lead Acetate (Sugar of Lead)
Liquor — Pulp Mill: Sulfite
Magnesium Chloride
Photographic Developers
Silver Nitrate
Soda Ash (Hot)
Sodium Chlorate
Zinc Chloride

In category (3) where the absence from bronze of certain elements such as lead or zinc is desirable, and is frequently so specified by the ultimate user, the engineer can be confused by the numerous alloys from which he can choose.

Table 2 begins on page 148. Text continues on page 150.

Use this table to match centrifugal pump

TABLE 2. — REFERENCE LIST of some of the bronzes made by American manufacturers. Figures indicate percentage of each element present in alloy. Where total does not equal 100 percent, traces of other elements are present

	Name	Copper	Tin	Zinc	Lead	Phosphorus	Iron	Other Elements	Uses	Remarks
1	Bronze, Iron	82.5	8.6	4.4	...	...	4.0	...	Shafts, piston rods, screws, marine parts	Resists sea water corrosion
2	Elephant Brand Phosphor Bronze Grade S	Balance	9.0-11.0	...	8.0-11.0	0.7-1.0	...	...	Bearings for locomotive, marine and stationary engines, roll neck bearings, piston rings	Very hard and durable
3	Nickel Bronze	82.0	8.0	2.0	...	...	...	8.0 Nickel	Superheated steam parts	Corrosion resistant
4	Valve Bronze	83.0	4.0	7.0	6.0	...	...	...	Valves	Corrosion resistant
5	Dudleys Phosphor Bronze	80.0	10.0	...	9.6	0.8	...	...	Bearings	Heavy duty
6	Bridge Bronze C	80.0	10.0	...	10.0	0.7-1.0	...	...	Bearings	Heavy duty
7	Arsenic Bronze	80.0	10.0	...	9.2	...	...	0.8 Arsenic	Bearings	Heavy duty
8	Leaded Phosphor Bronze	80.0	10.0	...	10.0	...	...	...	Bearings for high speed and heavy pressures	Resists shock and vibrations
9	Standard Phosphor Bronze	80.0	10.0	...	10.0	Up to 0.25	...	...	High speed bearings	Heavy duty
10	Ajax Phosphor Bronze	79.7	10.0	..	9.5	0.7	...	...	Bearings	...
11	Phosphor Bronze English No. 1	79.5	10.2	...	9.6	0.7	...	...	Fittings exposed to sea water, Small Springs, Bearings	High resistance to corrosion and fatigue
12	Semi Plastic Bronze	79.0-75.0	7.0-9.0	...	13.5-16.5	...	...	...	Machine bearings	Leaded bronze
13	Kern's Hydraulic Bronze	78.0	12.0	10.0	...	...	...	...	Vessels, pressure castings, valves, fittings	High strength
14	Kuhne Phosphor Bronze	78.0	11.0	...	10.0	0.6	...	0.3 Nickel	Hard bearings	Heavy duty
15	S.A.E. No. 67 Semi-Plastic Bronze	76.5-79.5	5.00-7.00	4.0 Max.	14.5-17.5	...	0.40 Max.	0.4 Max. Antimony 1.00 Max impurities	Soft bronze bearing, water pump bearings	Good antifriction qualities
16	Bronze, Carbon	75.0	9.7	...	15.0	...	...	...	Bearings	...
17	Phosphor Bronze American No. 1	70.0	13.0	...	16.0	1.0	...	...	Fittings exposed to sea water ,small springs	High resistance to corrosion and fatigue
18	Plastic Bronze	66.0	5.0	...	28.0	...	...	1.0 Nickel	Bearings	Heavy duty
19	Plastic Bronze Ajax	64.0	5.0	...	31.0	...	...	...	Bearings	...
20	Ajax Plastic Bronze	64.0	5.0	...	30.0	...	...	1.0 Nickel	Bearings	...
21	Kramer "X.X." Manganese Bronze	63.0	...	Bal.	...	...	2.0	2.5 Manganese, 5.0 Aluminum	Piston rods, valve stems, propellers, fittings	Corrosion resistant
22	Bronze-Vanadium	61.0	...	38.5	...	...	...	0.5 Vanadium	Pipes, tubes, fittings	High strength
23	Titan Bronze "B"	60.5	1.02	38.5	...	...	...	...	Marine shafts, under water fittings	Non-corrosive
24	Mueller Bronze Blue Tip	60.36	0.94	38.6	...	...	...	...	Nuts, bolts, condenser tubes, marine parts	Corrosion resistant
25	Chamet Bronze Type A	60.0	0.75	39.25	...	...	...	...	Welding rod, bolts, screws	Resists sea water
26	Bronze Leaded Chamet	60.0	0.75	38.5	0.75	...	...	...	Pipes, tubes, fittings	Free cutting
27	Bridgeport Bronze	60.0	0.75	Bal.	...	...	...	...	Condenser tubes, water pipes, nuts, bolts	Corrosion resistant
28	Ajax Special Valve Stem Bronze	60.0	...	37.0	1.0	...	...	2 Special hardeners	Valve stems	Free cutting
29	Titan Manganese Bronze	59.2	0.9	Bal.	...	..	0.9	0.4 Manganese	Bolts, rods forgings	Corrosion resistant high tensile
30	Bronze Victor	59.0	39.0	...	...	...	1.0	1.5 Aluminum, 0.03 Vanadium	Pipes, tubes, fittings	Corrosion Resistant
31	S.A.E. No. 73 Naval Brass Rod (Tobin Bronze)	59.0-62.0	0.5-1.0	Bal.	0.3 Max.	...	0.10 Max.	...	Piston rods, propeller shafts, plates, bolts, nuts, gears, gear bearings	Resistant to sea water corrosion
32	Chase Manganese Bronze	58.0	1.0	38.9	...	...	1.0	0.1 Manganese	High strength bolts	Tough
33	Valve Bronze	89.0	5.0	3.0	3.0	...	...	...	Valves	Corrosion resistant
34	Valve Bronze	89.0-85.0	2.5-10.0	0.9	0.-6.0	...	...	...	Valves	Corrosion Resistant
35	Tantalum Bronze	Bal.	...	...	...	...	...	1.25 Molybdenum, 0.20 Tantalum, 10.0 Aluminum	Steam fittings, valves	Corrosion resistant
36	Bronze Steam Valve	88.0	10.0	2.0	...	...	...	...	Steam valves	...
37	Bronze, Hard	88.0	10.0	2.0	...	...	...	...	Gears, bushings	...
38	Standard Admiralty Bronze	88.0	10.0	2.0	...	...	...	...	Bronze castings, gears, worm wheels	Tough, wear resistant
39	Bronze, Lafonds Pump	88.0	10.0	2.0	...	...	...	...	Gears, worm wheels, pump parts	Tough
40	Bronze, Cocks	88	10.0-8.0	2.0-6.0	...	...	...	...	Cocks, fittings	Corrosion resistant
41	Naval Phosphor Bronze (P-c) Cast	88.0	8.0	4.0	...	0.5	..	...	Bearings, gears marine parts	corrosion U.S.N.-46-B5f

requirements with available bronze alloys

TABLE 2 — Continued

	Name	Copper	Tin	Zinc	Lead	Phosphorus	Iron	Other Elements	Uses	Remarks
42	Bronze Steam Fitting	88.0	8.0	2.0	2.0	...	...	...	Steam fittings	Pressure tight
43	Naval Bronze	88.0	8.0	4.0	...	...	...	...	Steam and structural bronze, expansion joints, gears, valves, bearings	Tough
44	Hard Bronze	88.0	7.0	3.0	2.0	...	...	...	Gears and bushings	Tough
45	Naval Valve Bronze	88.0	6.5	4.0	1.5	...	...	...	Valve stems, valve seats, valve bodies	"Composition M" U.S.N.-46 B8d
46	Standard Nickel Bronze	88.0	5.0	2.0	...	...	...	5.0 Nickel	Valves, corrosion resistant parts	Corrosion resistant
47	Chase "444" Bronze	88.0	4.0	4.0	4.0	...	...	...	Bearings, condenser tubes	Corrosion resistant to brine, alkalis
48	Special Free Cutting Phosphor Bronze 610	Bal.	4.0	4.0	4.0	...	...	...	Bearings, bushings, valve and pump parts gears, pinions	Free cutting, wear resistant
49	Bronze, Nickel Aluminum	88.0	...	...	...	...	...	10.0 Nickel 2.0 Aluminum, Tin	Heat and corrosion resisting parts	High strength
50	Bronze, Diamond	88.0	...	...	...	...	...	10.0 Aluminum, 2.0 Silicon	High strength corrosion resisting castings	Wear resistant
51	Bronze Leaded	88.0-62.0	...	10.0-35.0	...	...	...	...	Fittings, screws, nuts, bolts	Free cutting
52	Bronze, Sillman	86.4	...	...	...	...	3.9	9.7 Aluminum	Strong corrosion resisting parts	Aluminum bronze
53	Bronze, Screw Nut	86.0	11.0	2.3	...	...	...	...	Screws and nuts	Corrosion resistant
54	Admiralty Bronze Modified	86.0	8.0	4.0	2.0	...	...	...	Valves, fittings	Pressure tight
55	Government Bronze	86.0-89.0	7.5-11.0	1.5-4.5	0.3	...	...	0.75 Nickel	Valves,gears, fittings, steam valves	Composition "G"
56	Apex Bronze	86.0	...	...	...	...	Bal.	9.5 Aluminum	Marine parts	...
57	Reich's Bronze	85.0	...	...	...	...	7.5	0.6 Aluminum, 0.5 Manganese	Strong corrosion resistant parts	Corrosion resistant
58	Dawsons Bronze	83.9	15.9	...	0.10	...	...	0.5 Arsenic	Journal bearings	Very fluid
59	Bronze, Chinese	83.0-72.0	1.0-13.0	0.7-14.0	10.0-20.0	...	Bal.	...	Bearings	Heavy duty
60	Corvic Bronze	98.5	1.5	...	...	...	...	...	Chemical engineering equipment	Corrosion resistant
61	Bronze Lafonds Malleable	98.0	2.0	...	...	...	...	...	Sheets, tubes, wire	Corrosion resistant
62	Phosphor Bronze 5% (Gr,A) 351	95.0	5.0	...	...	...	...	...	Tubes, sheets, wire, general parts	Resists fatigue corrosion and abrasion
63	Phosphor Bronze American No. 2	95.0	4.9	...	...	0.1	...	...	Screw propellers, worm wheels, bearings	High resistance to corrosion and fatigue
64	Bierman Tungsten Bronze	95.0	3.4	...	...	...	...	1.6 Tungsten	Strong corrosion resistant parts	Corrosion resistant
65	Sun Bronze	95.0	...	...	...	...	...	5.0 Aluminum	Pump rods, bushings, propeller blade bolts	Corrosion resistant
66	Bronze Screw	94.0	1.0	5.0	0.5	...	...	...	Screws, nuts, bolts	Free cutting
67	Phosphor Bronze Russian	93.7	5.8	0.34	...	0.16	...	...	Screw propellers, fittings exposed to sea water, bearings, worm wheels	High resistance to corrosion and fatigue
68	Bronze, Tetmaier Aluminum	93.0-86.0	...	...	...	...	0.7-1.0	4.6-10.0 Aluminum 1.0-2.7 Silicon	Bushings, fittings	Tough, high strength
69	Bronze Yale	92.5-90.0	0.5-1.5	7.5-8.0	0.7-1.5	...	...	...	Screw machine parts bolts, nuts, bushings	Free-cutting
70	Bronze Uchatius (Uchatin's)	92.0	8.0	...	...	...	...	...	Bearings, gears, worm wheels	Wear resistant
71	Chase Nickel Aluminum Bronze	92.0	...	...	...	...	...	4.0 Nickel, 4.0 Aluminum	Condenser tubing, pipe an corrosion resistant purposes	Corrosion resistant
72	Omega Brand Phosphor Bronze No. 209	90.0	10.0	...	...	...	...	Trace Phosphor In Sulphide Solution	In paper mill machinery	...
73	Phosphor Bronze 10% (Gr.D) 354	90.0	10.0	...	...	...	...	...	Tubes, sheets, wire, general parts	Resist fatigue and corrosion
74	Frontier No. 11	90.0	6.5	2.0	1.5	...	...	...	Bearings, screws, bolts	Formerly Bronze 11
75	Lumen No. 14	90.0	6.5	2.0	1.5	...	...	...	Valve bodies, oil pumps	Known as valve or Steam Bronze
76	Ajax Plastic Bronze	90.0	5.0	...	5.0	...	...	...	Bearings	...
77	Litinum Bronze	90.0	4.7	3.86	1.6	...	...	...	Nuts, bushings, bearings screw machine parts	Free cutting
78	Bronze Phosphor Grade "D"	89.5	10.5	...	...	...	...	...	Worm wheels, pumps	Tough
79	Bronze, Tin	89.0	11.0	...	...	...	...	...	Bearings, gears, worm wheels	Wear resistant
80	Lumen No. 9	57.5	0.75	40.0	...	...	1.0	0.5 Aluminum, 0.25 Manganese	Propeller blades and hubs, valves, pump bodies	Known as Manganese Bronze
81	Marine Bronze	57.5	0.15	Bal.	...	...	...	0.8 Nickel 0.5 Aluminum	Marine parts	...

centrifugal pumps and the bronzes

TABLE 2 — Continued

	Name	Copper	Tin	Zinc	Lead	Phosphorus	Iron	Other Elements	Uses	Remarks
82	McKechnie's Bronze	57.0	1.0	41.0	0.5	...	1.0	...	Rods, nuts, bolts	High strength
83	Manganese Bronze 937	57.0-62.0	0.5-1.5	36.0-40.0	...	...	0.5-1.0	0.5 Manganese	Valve stem forgings, slotted and perforated screens	High strength and toughness, resists action of salt water
84	Turbiston Bronze	55.0	...	41.0	...	...	0.84	2.0 Nickel, 1.0 Aluminum, 0.16 Manganese	Pistons	Highly resistant to sea water. Also called a Brass
85	Nickel Manganese Bronze	53.0	2.6	39.0	...	...	...	2.5 Nickel, 1.7 Manganese, Aluminum Lead	Corrosion resistant strong castings	Corrosion resistant
86	Bronze Steel (Stahl)	52.0-59.0	...	36.0-43.0	...	...	1.0	2.5-3.0 Manganese 1.0 Aluminum	Propellers, marine parts	Same as "Uchatius Bronze"
87	Machine Bronze	50.0	25.0	...	...	...	...	25.0 Nickel	Bearings	Wear resistant
88	Bronze, Sea Water	45.0	16.0	5.5	...	...	...	33.0 Nickel 1.0 Bismuth	Marine parts	Corrosion resistant
89	Delta Bronze 111	40.0-98.0	0.1-10.0	1.8-45.0	...	...	0.1-5.0	...	Solid drawn tubes for hydraulic purposes, condensers, gears, valves, pump parts	Corrosion resistant
90	Sun Bronze	30.0-50.0	...	...	...	...	...	60.0-40.0 Cobalt, 10.0 Aluminum	High temperature fittings	Heat resistant
91	Johnson Bronze Babbitt No. 11	6.0	87.0	...	...	...	...	7.0 Antimony	Bearings	Bronze Babbitt
92	Johnson Bronze Babbitt No. 10	5.0	90.0	...	...	...	...	5.0 Antimony	Bearings	Bronze Babbitt
93	Naval Bronze No. 4	4.0	36.0	...	44.0	...	...	16.0 Antimony	Bearings	Anti-friction
94	Johnson Bronze Babbitt No. 97	2.5	90.0	...	...	..	...	7.5 Antimony	Bearings	Bronze Babbitt
95	Buckeye Bronze	0.6	41.6	37.8	15.6	..	...	4.3 Aluminum	Bearings	Babbitt

While materials should be selected by a metallurgist many companies do not employ such a specialist and, even if they did, he would, wherever possible, rely heavily on the evidence of past field behavior.

Selection May Be a Compromise

The old cliches that "nothing is perfect in this world" and "one can't have everything" could very well have been said by a pump engineer with an unusual liquid to handle.

While there are thousands of centrifugal pumps which have continuously operated for 40 years on water there are the unusual applications where, with the very best design and materials, pump life is measured in months.

TABLE 3 — LEAD FREE BRONZES. Numbers refer only to Table 2

1, 3, 13, 21, 22, 23, 24, 25, 27, 29, 30, 32, 35, 36, 37, 38, 39, 40, 41, 43, 46, 49, 50, 51, 52, 53, 56, 57, 61, 62, 63, 64, 65, 66, 68, 69, 71, 72, 73, 74, 79, 80, 81, 82, 84, 85, 87, 88, 89, 90, 91, 92, 93, 95.

TABLE 4 — ZINC FREE BRONZES. Numbers refer only to Table 2

2, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 18, 19, 20, 30, 35, 49, 50, 52, 56, 57, 58, 61, 62, 63, 64, 65, 66, 69, 71, 72, 73, 74, 77, 79, 80, 88, 91, 92, 93, 94, 95.

For convenience, Table 3 is a list of those numbers in Table 2 which are lead free bronze.

Table 4 is a list of those bronzes which are zinc free.

Erosion May Exclude Bronze

Applications in category (4) are those where bronze is rejected in favor of a harder material, usually because the harder material will resist the erosive action longer and by this resistance prolong pump life.

Erosive action may be the result of abrasives in the liquid or of cavitation resulting from inadequate pump suction conditions. Substitution of harder materials will normally increase pump life but in the case of cavitation the proper solution is to change suction conditions.

In some instances the necessity for another material can be determined only by field experience. On occasion, a material which would seem to be harder and generally better is rejected in favor of one of the tougher bronze alloys. ⧧

References

1) International Nickel Publications
2) Engineering Alloys — Woldman
3) S.A.E. Handbook
4) Hydraulic Institute Standards

In large building air conditioning . . .

Good Water Treatment Equals Dollars Saved

By URBAN D. KAPLER
Metropolitan Refining Co., Inc.

Good water treatment is a full scale partner, and should work full time, in the successful operation and maintenance of any large-scale air conditioning system. Know what it involves and what it can do to protect the owner's investment.

SINCE the average owner or operator expects his air conditioning equipment to last for the approximate life of the building which it serves, corrosion protection for the air conditioning system is a factor which cannot be lightly brushed aside.

Costs of necessary repairs or replacement of corroded piping, condensers, and other components may represent only a small proportion of the total cost of negligent maintenance of equipment. The downtime involved in production, the loss of client goodwill, or the actual loss of building tenancy can be a far more serious economic consequence.

Most of the confusion generated in the water treatment field relates to recommendations for corrosion protection. In view of a confusing number of claims and proposals for "complete" water treatment programs, prospective buyers of water treatment for their air conditioning equipment may welcome a brief, frank discussion of the basic facts needed to evaluate such proposals.

Inhibitors Standardized

Sodium bi-chromate or sodium nitrite are generally considered the best inhibitors against corrosion in air conditioning equipment. To protect the average system at five cycles of concentration, the level of these chemical inhibitors should be maintained at a minimum of 300 parts per million (ppm) in the recirculating water.

The amount of treatment required, however, can vary rather sharply, depending upon the analysis of the water. For example, in Phoenix, Arizona, systems operating at five cycles of concentration and using city water for makeup would require a minimum of 500 ppm.

This higher treatment level is specified in that location because Phoenix city water contains relatively high percentages of chlorides and sulphates, which promote corrosion problems.

Furthermore, the chloride and sulphate content of the water is simultaneously increased in direct ratio to the number of cycles of concentration that is maintained.

"Economy" May Be Unwise

It would not be wise to attempt to economize by maintaining lesser concentrations of chemical corrosion inhibitors than that required for the specific water being used in a system. The reason for this is that such anodic inhibitors, if not carried at a sufficiently high concentration, will leave some metal surfaces unprotected and allow pitting to take place.

Maintenance of a concentration of 300 ppm of chemical inhibitor in the average 100 ton capacity, electrically operated air conditioning system at five cycles of concentration would require 2.75 lb of inhibitor in a 24 hr period.

In the case of systems requiring 500 ppm treatment, as in Phoenix, 4.5 lb of corrosion inhibitor would be necessary for a 24 hr period. Absorption equipment requirements must be figured at twice these amounts, since twice the heat must be dissipated for each ton of capacity.

Polyphosphates Prevent Scale

As far as scale prevention is concerned, the commonly employed treatment for this purpose utilizes polyphosphates. These are required in a recirculating cooling tower system at a maximum concentration of 5 ppm.

The amount of continuous treatment required to maintain this level will vary, depending upon the cycles of concentration at which the water is being maintained. The amount required varies with the amount of bleed-off necessary, and with other factors.

In no case, however, would this rate of feed be greater than 1 oz for each 1000 gal of fresh water taken into the system, after an initial charge at the same ratio for water already present in the system.

Inhibitors Do One Job

It must be borne in mind that polyphosphates are effective only as a scale inhibitor. They have little value in preventing corrosion, and, under ordinary circumstances, such value can be disregarded. In fact, polyphosphates in concentrated form may be corrosive in themselves. Where they are employed singly, for certain specific water treatment purposes, special feeding equipment must be used to administer them, in order to avoid corrosive damage to the equipment.

Alkalinity Special Problem

For highly alkaline waters, when the equipment tonnage is of sufficient size to justify the added capital expenditure for the necessary feeding equipment, it is the usual practice to add sulfuric acid to the tower system.

One purpose of such acid treatment is to reduce the alkalinity of the water so that the bleed-off can be kept to a minimum. This is strictly a matter of economics, for the reason that whatever chemicals are lost through bleed-off must be continually replaced to insure the necessary minimum concentration of treatment.

The quantities of either polyphosphates or sulfuric acid, or both, required to treat a specific system are relatively minor, when related to the volume of water handled.

As an illustration, a 100 ton electrically operated air conditioning plant, employing Phoenix city water for makeup, and operating at five cycles of concentration, would require approximately 4 oz of polyphosphate for a 24 hr period. The sulfuric acid requirements at 66 deg Baume at the same time would be approximately 6 lb.

Specialists May Be Needed

If the size of the system or the expected extent of the water treatment problem warrant consultation with water treatment specialists, several considerations should be taken into account.

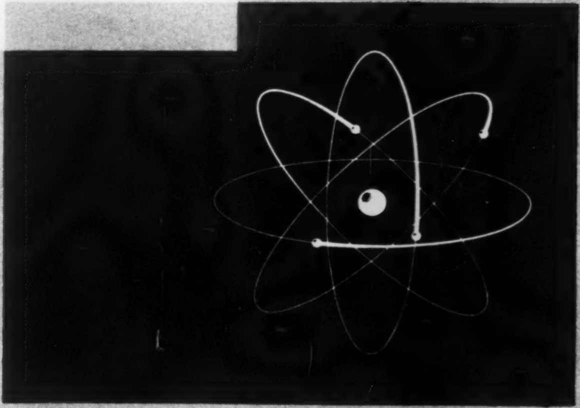
It should be remembered that there are no drastic short cuts, and no miracle cures, for the corrosion problem. It therefore behooves the owners, operators, and designers to satisfy themselves as to the degree of completeness on any water treatment proposal. One important factor in the successful operation of any system will be effectiveness of the service offered — including periodic water tests and regular inspections.

High standards of water treatment are a vital factor in attaining high standards of efficiency and operation in any air conditioning system. ‡

HPAC ENGINEERING DATA FILE

What to Consider When Designing Nuclear Piping Systems

- *What codes apply?*
- *Does radiation damage piping?*
- *Is corrosion a problem?*
- *Consider accessibility for maintenance*
- *Key factors in containment design*



In this report, we present some of the things that must be considered in designing the pressure piping systems for nuclear plants and the secondary containment shell which houses the reactor. Since the type of reactor affects the piping design considerations, the various reactor concepts now being developed are discussed. Some of the factors to be considered in piping design that are presented herein include the application of the existing codes to nuclear piping, the effects of radiation on piping materials, some of the corrosion problems encountered, and the need for considering accessibility for maintenance in design.

Nuclear power plants continue to increase in number as the civilian reactor program develops. At present, 13 power reactors are operable and 20 others are under construction. In addition, numerous small research and test reactors are in operation. Impetus for future use of nuclear energy in industrial process heating has been given by the decision to build a reactor to generate steam solely for this purpose. While competitive nuclear power for process heating is still several years away, its use for power generation and other purposes will involve more engineers and mechanical contractors in the design and installation of the necessary piping and containment facilities.

Nuclear Piping System And Reactor Containment Design Considerations

CONTINUING ACTIVITY and advancements in technology bring closer to reality, the day when nuclear energy will power central space and process heating installations. A step in this direction was taken when a proposed research program was established to develop process heat in the Experimental Low-temperature Process Heat Reactor. (ELPHR). At present, however, the use of nuclear energy for these purposes for economic reasons would seem to be confined to district heating systems or those required in large industrial installations. The 13 operable power reactors, designed and constructed to develop information applicable to the production of electricity, and the 20 others under construction are a stimulus to the anticipated growth of nuclear power plants, especially in geographic locations having high energy costs. As these and other uses of nuclear energy continue to grow, an increasing number of engineers and mechanical contractors will become involved in nuclear piping system design and installation.

In this report, we consider the ways that nuclear piping systems may differ from other pressure piping systems, and some of the special considerations that are now being observed because of the nature of the material handled.

Reactor Concepts Under Study or In Operation

In the civilian reactor program the Atomic Energy Commission has undertaken a study of various reactor concepts. As noted earlier, 13 power reactor plants are in operation and many others are under construction. Piping and other design problems are related in many instances to the specific type of reactor involved. Consequently, these concepts are considered here and for convenience the reactors are classified according to the type of coolant used. The various concepts under consideration in the civilian program are given in the table at the left.

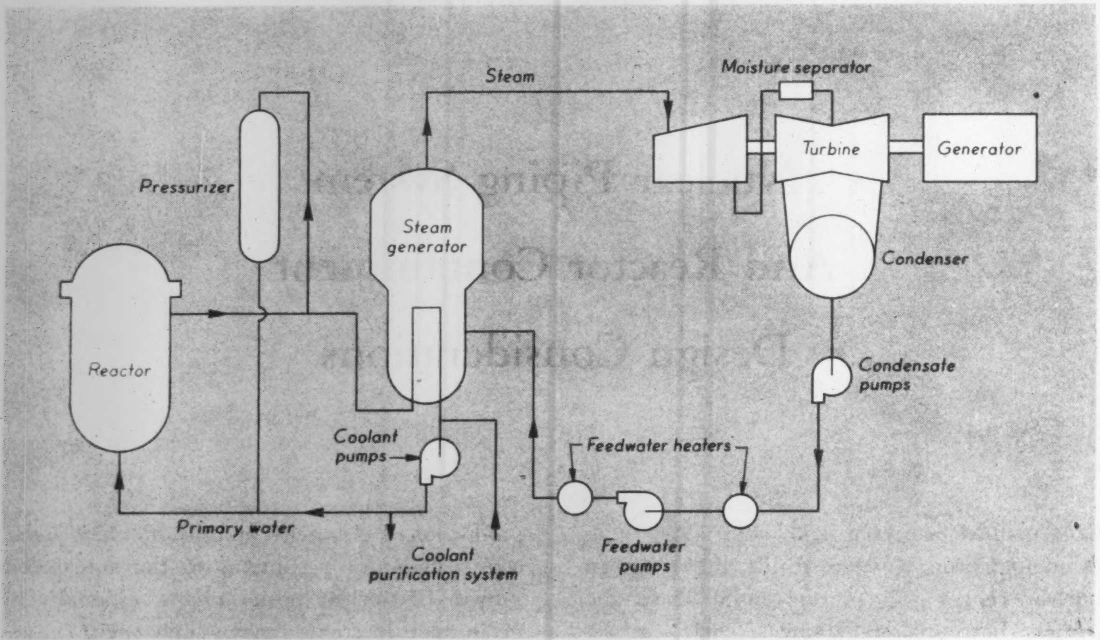
Type of Reactor	Typical primary coolant fluids
Water Cooled	
Pressurized (non-boiling)	Light water
Boiling	Light water
Nuclear Superheat	Light water
Liquid Metal Cooled	
Sodium cooled-graphite moderated	Sodium
Fast reactors	Sodium
Heavy Water Cooled	Heavy water
Organic-Cooled	Diphenyls, terphenyls
Aqueous-homogeneous	Uranyl sulfate; slurries
Gas Cooled	Helium, Carbon dioxide

Pressurized Water Reactors

In this concept, ordinary light water[1] of high purity is used in a pressurized primary coolant loop both as reactor coolant and moderator. The pressure in the primary loop is maintained, by

---

[1] *Numerals refer to references on page 168.*



PRESSURIZED WATER REACTOR vessel and primary piping system shown schematically here is maintained at sufficient pressure to prevent boiling in the reactor core. Primary cooling water is maintained at a high degree of purity to minimize radiolytic formation of oxygen, corrosion, and formation of insoluble products that would become radioactive. This same basic layout is used with reactors employing organic coolants, however, the pressurizer is then omitted

means of an auxiliary pressurizer, at a value greater than the saturation pressure corresponding to the bulk temperature of the coolant leaving the reactor during normal operation. Operating reactors have been designed for pressures from 1200 to 2000 psia. The upper limit of pressure is established by an engineering compromise of economy and fabrication considerations. The steam pressure that can be generated by the primary coolant and therefore the plant efficiency are a function of the pressure maintained in the primary circuit.

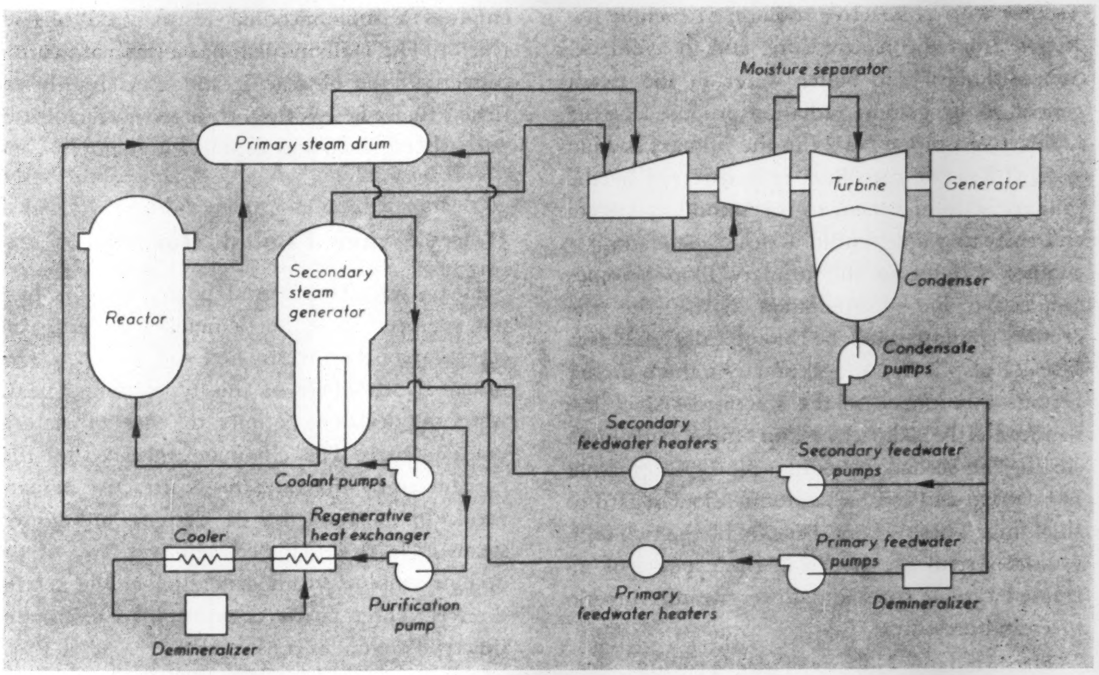
A water-to-steam convertor (heat exchanger) is provided in the primary system to generate steam for the secondary piping circuit. It is this steam which is used to drive the turbines. The primary and secondary water are in closed circuits completely isolated from each other.

In reactors of this concept, only the primary coolant piping is exposed to irradiation by the core, and then only a small part of it. A high degree of water purity is maintained in this circuit to minimize radiolytic dissociation, corrosion, and the formation and deposition of radioactive "crud" (insoluble products) in the system.

A reactor of this type was used in the Shippingport, Pennsylvania atomic power plant. Two other large civilian power plants will use pressurized water (non-boiling) reactors.

Comparative cost studies indicated that the pressurized water reactor would result in the lowest cost process heating plant and would offer the greatest potential for cost improvement. Consequently, this type of reactor was selected for the first process heating application of nuclear energy — the ELPHR program mentioned above.

The ELPHR system will utilize a low alloy steel primary piping system and will employ wherever possible, available components. Since the system will be used for experimental purposes to improve the process heating technology, it will be operated over a wide range of conditions. It will be designed to produce saturated steam at 180 psig. Its capacity at this pressure will be 150 thousand lb of steam per hr. Initially, however, due to limitations on the temperature to which the fuel elements in the reactor core can be subjected, the system will produce only 15 psig saturated steam with a capacity of about 120 thousand lb of steam per hr.


Moisture separator
Primary steam drum
Turbine
Generator
Reactor
Secondary steam generator
Condenser
Condensate pumps
Secondary feedwater heaters
Secondary feedwater pumps
Coolant pumps
Regenerative heat exchanger
Cooler
Primary feedwater pumps
Purification pump
Primary feedwater heaters
Demineralizer
Demineralizer

BOILING WATER REACTOR is designed so that the water coolant boils directly within the core. Steam is separated from the steam-water mixture in the primary steam drum and piped directly to the turbine. Primary water is used to generate secondary steam which is also used to drive the turbine. Circulating water must be purified to avoid excessive radioactivity in turbines, pumps, and other components to minimize the need for biological shielding of these parts

Boiling Water Reactor

The boiling water reactor[2] differs from the pressurized water reactor in that boiling of the light water coolant occurs directly within the core. The reactor vessel pressure is then saturation pressure corresponding to the bulk temperature. Thus, the operating pressure is much lower in this type of reactor.

The boiling water reactor is more flexible from a design standpoint than its non-boiling counterpart because the steam generated in the core can be used in both direct and indirect steam cycles, as well as in combination systems. Additionally, superheating of the steam is believed to be practical within the reactor core, thus eliminating an intermediate heat exchanger. By suitable design, either natural or forced circulation or both in combination can be used for cooling the reactor core.

A reactor of the boiling water type powers the Dresden Nuclear Power Station near Chicago. In this system, reactor steam is used directly at 980 psig and 546 F in the turbine and used indirectly to generate steam at 500 psig and 469 F. Several other commercial power plants now under construction employ the boiling water type of design.

Liquid Metal Cooled Reactors

Several liquid metal coolants have been considered for reactors because of their excellent heat transfer properties. At present, some reactors[3] under development use liquid sodium. Other liquid metals considered include bismuth, mercury, sodium-potassium, lithium and lead. In addition to good heat transfer (heat fluxes of 1 to 3 million Btu per hour per square foot can be employed), the high boiling points permit low pressure (some primary loops are designed for ¼ psig) heat removal from the core with a high temperature rise. The latter, which can be as much as 300 to 600 F, reduces pumping costs. Forced convection of the sodium coolant is required.

Present designs[3] utilize primary and secondary sodium systems to insure against a sodium-water reaction with radioactive sodium, to exclude hydrogen from the reactor core, and to avoid decomposition of the boiler water in the steam generators by gamma radiation produced by the radioactive isotope Na-24 in the primary sodium system. Reactor core heat is transferred by the primary sodium system to the secondary system and then to water within a steam generator.

Since sodium in the primary loop becomes radioactive due to irradiation in the core, the primary piping must be biologically shielded. The use of primary and secondary sodium piping permits a reduction in the amount of shielding required as the radioactive loop can be made quite small. The secondary sodium piping loop is not radioactive and can be located without regard to shielding. These several benefits of the two loop sodium system are gained at the expense of increased capital costs and lower steam temperatures and pressures.

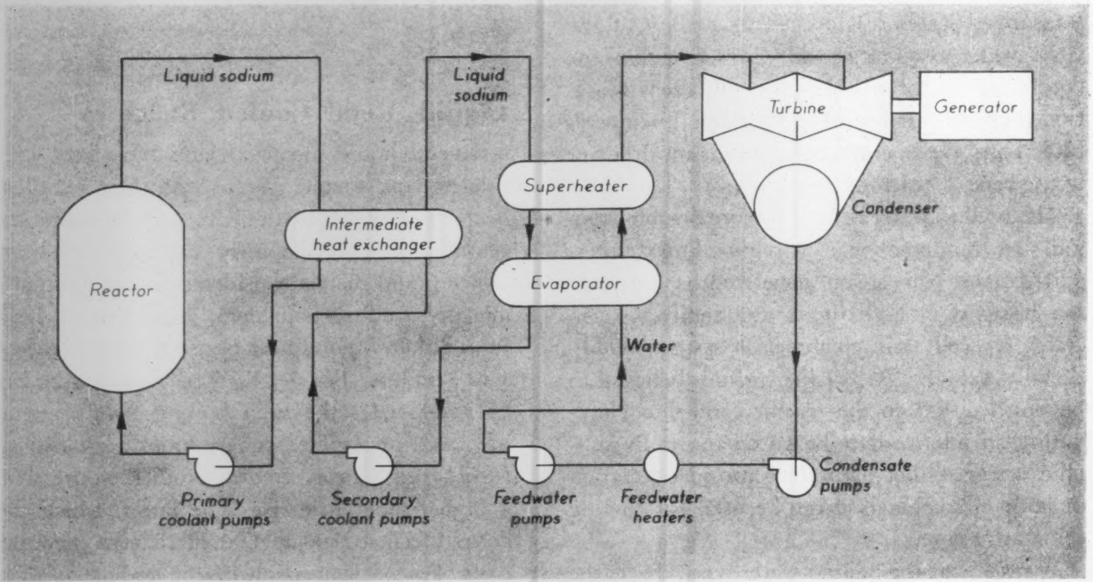
The Hallam Nuclear Power Facility near Lincoln, Nebraska, which is scheduled for completion in 1961, employs a sodium-cooled, graphite-moderated reactor. The Enrico Fermi Atomic Power Plant on Lake Erie near Detroit employs a sodium-cooled fast-neutron breeder reactor. The Hallam plant has a thermal neutron converter type of reactor and uses slightly enriched fuel whereas the fast breeder reactor uses partially enriched and depleted uranium.

Heavy-Water Cooled Reactors

Heavy-water moderated power reactors have not yet been built, but a number of such concepts have been investigated and designed. One principal advantage of this type[4] is that heavy water moderation permits the use of natural uranium fuels. This eliminates the need for fuel enrichment facilities and this is attractive in many areas. In most of the 21 designs, an indirect steam cycle is anticipated, however, two of the designs employ steam generated in the reactor directly. Three power demonstration reactors of this type are under construction.

Organic-Cooled Reactors

The reactors[4] of this concept employ various



LIQUID SODIUM COOLED REACTOR piping system because of reaction of sodium and water and to avoid reaction of radioactive sodium with water employs three stages of heat transfer. The primary sodium coolant, which becomes radioactive and must be biologically shielded, transfers heat to the secondary sodium loop. The latter then transfers heat to water within the steam generator. Low reactor pressures and high heat transfer coefficients result in design economies organic (hydrocarbon) liquids as coolants. Mixed diphenyls and terphenyls have been considered. These fluids offer as a major advantage the production of high steam temperatures at low reactor pressures. Also, corrosion problems are minimized and fluids in use do not become highly radioactive. Disadvantages of the organic coolants are low coefficients of heat transfer, and a tendency for the organic coolants to decompose and polymerize under irradiation with possible deposition products on the heat transfer surfaces, and the expense for makeup to replace the decomposed fluid.

An experimental organic cooled reactor has been in operation for over a year. Construction is in progress on the first commercial organic cooled reactor at a small city in Ohio. This reactor is designed to generate steam at 450 psig, 550 F. Organic coolant enters the reactor at about 530 F and leaves at about 620 F.

Other Concepts Under Study

Various other reactor concepts are under study. Two of these are the aqueous-homogeneous[5] and the gas cooled types. The coolant of the first is a circulating solution of fuel in heavy water, in the second it is either helium or carbon dioxide gas. The development of aqueous-homogeneous reactors has been shelved because of the many and severe corrosion problems encountered. An experimental gas-cooled reactor is under construction and a full scale plant is planned for the Philadelphia area. In both, a two-loop system is used with the primary coolant transferring its heat to water through a steam generator.

Consider the Codes That Apply

The pressure piping system[6] is an important part of any nuclear plant. This importance stems not from the design conditions, but primarily from stringent safety considerations that must be applied to piping confining radioactive fluids or to piping upon whose integrity the safe operation of "hot" reactor parts depends. The piping system and its related components is the primary containment system. In a conventional power plant, a failure of the piping system will at worst result in release of water, steam, hydrocarbons and thermal energy. In a nuclear plant, such failure creates a series of other potential hazards. Depending on the nuclear reactor steam generating medium, these potential hazards[1] may be:

1) A release of highly radioactive materials and contamination of the surrounding area

2) A release of highly reactive chemical materials initiating combustion or even explosions

3) A release of energy in the form of pressure waves or missile fragments endangering the integrity of the reactor containment structure.

Nuclear Piping Defined

These various hazards were taken into account in the definition of nuclear piping written by the Advisory Committee on Nuclear Piping[7] of the Sectional Committee of the Code for Pressure Piping, ASA B31. In published[8] case N-1, an "enabling" case, the definition of nuclear piping is given as follows:

> *"Nuclear piping is that piping designed to contain a fluid whose loss from the system could result in a radiation hazard either to the plant personnel or to the general public."*

At the present time[7] there is no formal safety code pertaining to the design and construction of nuclear piping systems. However, the Code for Pressure Piping is proceeding towards a future code on the basis of modifications and interpretations of the existing Code through case decisions. The case decision method is considered the only approach to establishing interim safety requirements since safety regulations do not manifest themselves in weeks, months, or even years.

Power Piping Code Used As Guide

It should be noted here that Section 1 — Power Piping Systems — of the Code for Pressure Piping as it now stands is logically being employed[7] as the guide in the design of nuclear piping systems, i.e., primary loops and other pressure piping systems. Section 3 — Refinery and Oil Transportation Piping Systems — is the present Code section being used for guidance in the design of piping systems for spent fuel and other chemical reprocessing.

Categories of Nuclear Piping

Further amplification and interpretation of the Code definition was deemed desirable and accordingly the following two categories of piping have been tentatively established by the committee according to J. A. Klapper:[7]

"*Category* 1: Piping in continuous service whose failure could result in the release of material having a concentration of radioactivity greater than 1×10^{-6} microcuries per milliliter measured at room temperature and atmospheric pressure, and piping whose failure could result in the direct loss of primary coolant from a source of nuclear heating.

"Examples of piping systems which would fall in this category are:

"a) Nuclear heat source primary coolant system. This includes reactors, isotope heat sources, spent fuels, or other high level gamma sources.

"b) Main process stream of a spent fuel reprocessing plant.

"*Category* 2: Piping in intermittent service whose failure during periods of use could result in the release of material having a concentration of radioactivity greater than 1×10^{-6} microcuries per milliliter measured at room temperature and atmospheric pressure.

"Examples of piping systems which would fall in this category are:

"a) Ion exchange system washdown piping as would be found in a water-cooled reactor. This system would be used only during resin replacement operations.

"b) Primary coolant drain system between boundary drain valves and retention tanks.

"c) Fuel element cleanup system as would be used in a sodium-cooled reactor. This system would be used only during refueling operations."

It is believed by the Nuclear Advisory Committee[7] that the broad definition given above and the piping categories accomplishes three purposes:

1) They cover all cases embraced by the earlier definition.

2) They include the loss of a coolant wherein the leakage of relatively non-radioactive material may precipitate activity release. For example, they include such things as destruction of the reactor core and subsequent release of fission products due to loss of the coolant.

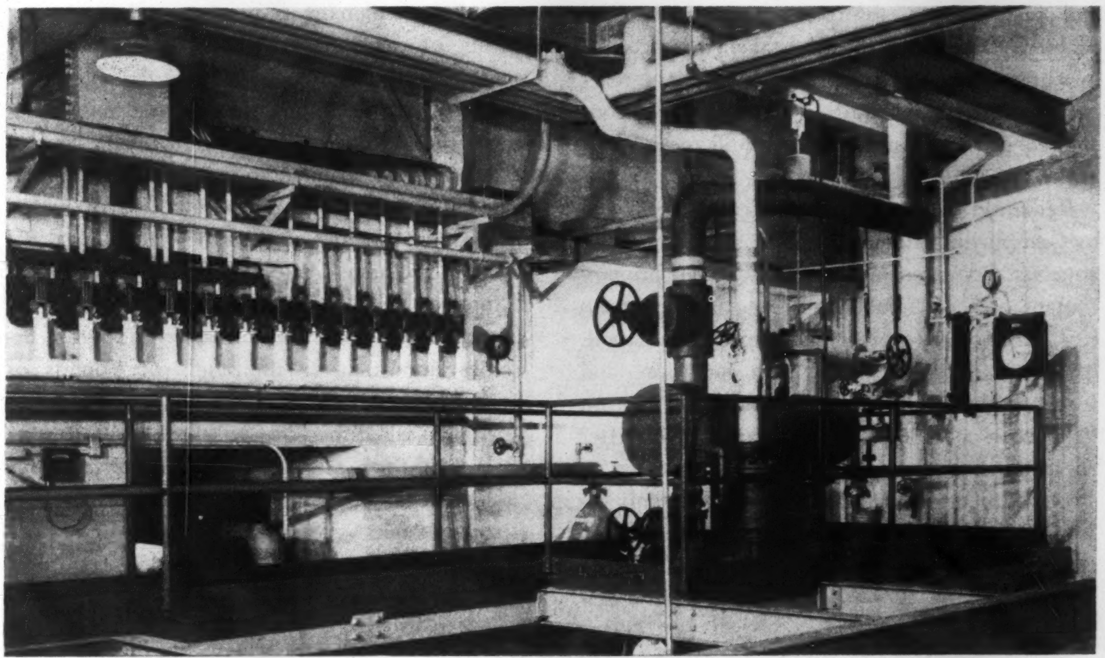
3) They fix the lower limit of radioactivity concentration to be considered, in much the same way as the present ASA B31 Code for Pressure Piping excludes any piping designed for operating pressures less than 15 psig.

The designation[7] of a lower limit of radioactivity is thought by the committee to be necessary because all materials are theoretically radioactive to a slight degree. Thus, mere reference to radioactive material in the definition would theoretically make all piping in the system "nuclear".

The limiting concentration specified, 1×10^{-6} microcuries per milliliter, is 10 times the permissible concentration now shown in Appendix B, Part 20, Title 10 of the Code of Federal Regulation for unidentified alpha, beta, and gamma emitters or mixtures of these existing in unrestricted areas accessible to the general public, (Table 11). No values are given in the Federal Regulation for such materials in restricted areas accessible only to plant employees (Table 1) wherein it is presumed all nuclear piping would lie. However, the permissible concentration shown for specific isotopes in restricted areas are all at least a factor of 10 higher than those shown for unrestricted areas. It is, therefore, felt[7] that the concentration specified in the *tentative* nuclear piping definition is justified and still an adequately safe minimum value for nuclear piping. The suggested value of 1×10^{-6} microcuries per milliliter should provide a reasonable base which would not require revision every time tolerances are changed. The Advisory Committee on Nuclear Piping recognizes that it should be concerned with significant levels of activity and not those slightly above background.

Where Other Code Sections Apply

Other piping in the nuclear plant which falls under the nuclear piping definition only as a



(Photo by Argonne National Laboratory)

PIPING to reactor auxiliaries such as start up heater shown here for a boiling water reactor also are considered nuclear piping. One of the major design considerations is corrosion and austenitic stainless steels have been used extensively in reactor piping installations for this reason. Manifold at left is for cooling biological shielding of the reactor and this piping is of conventional materials — in this case, copper tubing is used

result of a system malfunction or failure outside of the reactor installation design conditions would not be considered nuclear piping. This type of piping, which would include conventional steam and associated service piping, is designed and constructed under existing requirements in the appropriate sections of the Code for Pressure Piping.

It is the designer's responsibility[7] to follow the "nuclear piping" requirements in such instances if he considers the malfunction or failure to be a likely event, or if he plans for continuing system operation after such an event. An example of this would be the secondary steam system of a pressurized water reactor or the secondary sodium system of a sodium-cooled reactor if the design were such that operation would continue after discovery of a leak in the heat exchanger or steam generator separating the secondary and primary systems.

Does Radiation Cause Damage?

The effects of nuclear radiation[7] on piping materials have been and are the subject of considerable study. At low temperatures, irradiation increases the tensile and yield strengths and hardness of metals. Irradiation at low temperatures therefore, results in embrittlement or in an appreciable loss of ductility. At high temperatures, changes in tensile properties occur but at a slower rate.

Metals are less sensitive[7] to radiation effects than other materials. Because of the high neutron dosages required to cause changes in properties, only the piping near the reactor core will experience measurable changes. Even this is considered negligible[7] in the primary piping of water and liquid metal cooled reactors at the present time. However, another radiation problem — that due to metal internal heat generation from gamma ray and fast neutron absorption — must be taken into account. Gamma ray and fast neutron absorption and the cooling problem that results must be taken into account in water cooled reactor piping close to the reactor pressure vessel wall. It must also be considered in piping systems for liquid metal coolants.

Radiation damage is of more concern in reactors employing circulating fuel systems — the aqueous homogeneous concept.[5] The primary coolant or fuel circulating piping in these reactors is exposed to beta and gamma irradiation, low fluxes of delayed neutron radiation, and leakage neutrons from the core. The low neutron flux occurs as a result of neutron emission after the fuel leaves the reactor core. The intensity of "delayed neutron" irradiation is considerably below that known at the present time to result in metallurgical changes.

Radiation damage is proportional to the intensity of neutron flux. Fortunately, fluxes of magnitudes high enough to cause damage occur only in the core. Piping systems that must penetrate[6] the reactor vessel for the primary coolant loop and for instrumentation are exposed to high neutron fluxes. This piping may carry water, liquid metal or any of the other media used for primary coolants. The primary piping is typically comprised of 14 to 30 in. diameter piping in power reactors. Hence the matter of rupture becomes important as thousands of pounds of radioactive fluid can be ejected in a few seconds.

A pipe which becomes brittle through irradiation[6] may form a crack or number of cracks or it may shear off completely. Consequently, care should be taken in use to be sure irradiation embrittlement has not caused a hazardous condition.

Corrosion Is an Important Consideration

Corrosion is one of the most serious problems in nuclear power plants. Each type of reactor has a slightly different corrosion problem. Some of these are reviewed for each type below.

Pressurized Water Reactors

The corrosion problems in the primary coolant piping systems of pressurized water reactors are primarily related to the radiolytic formation of gas. The oxygen formed in this way can accelerate pitting corrosion and under confining circumstances accelerate crevice corrosion. The presence of oxygen with chlorides can result in stress corrosion cracking in certain austenitic stainless steel systems.

To minimize the formation[1] of gas by radiolysis and the corrosion and deposition of radioactive corrosion products or "crud" that goes with it, a high degree of water purity is maintained. Through ion exchange methods, water with an electrical resistance of 1 million ohms per cm is circulated in the primary circuits of pressurized water reactors.

Other steps taken in pressurized water reactors include scavenging the oxygen initially in the coolant with hydrazine. After this treatment, a hydrogen over pressure is maintained in the coolant to combine with and lower the concentration of oxygen. Concentration of dissolved oxygen is kept below 0.14 ppm in this way. The feasibility[1] of maintaining pH control with a lithium-hydroxide system has also been shown.

Various chemical corrosion inhibitors have been investigated. Alkaline corrosion inhibitors developed show promise of beneficial effects but not without disadvantages. In the pressurized water reactor these will be exposed to neutron bombardment and they must not be decomposed to any great extent. Lithium systems which show promise also have the following disadvantages:

1) Lowered efficiency of ion exchange resins.

2) Necessity to use Lithium-7 as the inhibitor and in the resin bed to avoid Hydrogen-3 formation.

Since successful corrosion inhibition has not yet been reduced to practice, the piping materials used in pressurized water power reactors to date have been those with a high degree of corrosion resistance in high-temperature, high-purity water. In early designs, the systems were constructed[1] of stabilized austenitic stainless steels (Types 347 and 348). Subsequent development has shown that non-stabilized grades (Type 304) have better weldability and are adequate for use in the pure water environment of the pressurized water reactors. Low alloy steels are being considered because of economic advantages but as yet need further study before they can be employed in reactor systems.

Case decision N-7 promulgated by the Piping Code Committee permits the use of Types 304, 347 and 348 as well as other austenitic stainless steels for piping in aqueous reactors. Both welded and seamless steel pipe can be used. The design temperature is limited to 800 F.

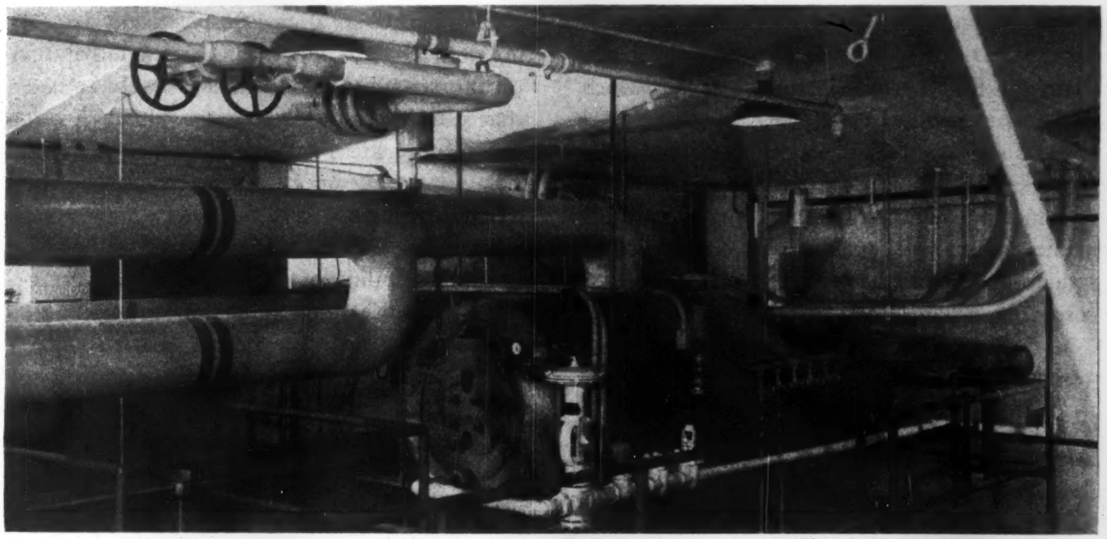
Boiling Water Reactors

The corrosion problems in boiling water reactors[2] are similar to those of the pressurized water reactor. A major system difference is that the reactor coolant — steam — may be piped directly to the turbines. Thus, if dissociation occurs, the turbine and other parts of the system will be exposed to high oxygen content. In addition, radioactive solids in the steam can be deposited in the piping system. It is essential, therefore, that corrosion be kept to a minimum and that the circulating water purity be maintained. To avoid overburdening the water purification system, corrosion resistant piping materials have been used. Type 304 stainless has been used[2] with success for reactor piping. The chief problem is to obtain in the large heavy lines adequate flexibility required to prevent excessive stresses from being developed when going from hot to cold conditions and the reverse.

Consideration has been given[2] to the use of lower alloy steels in the place of austenitic stainless steel for piping, pumps, etc. Lack of pH control and the oxygen content present may make this less attractive than it is for the pressurized water reactor systems. The lower alloys hold greater promise for valves and pumps if the circulating corrosion product problem is solved.

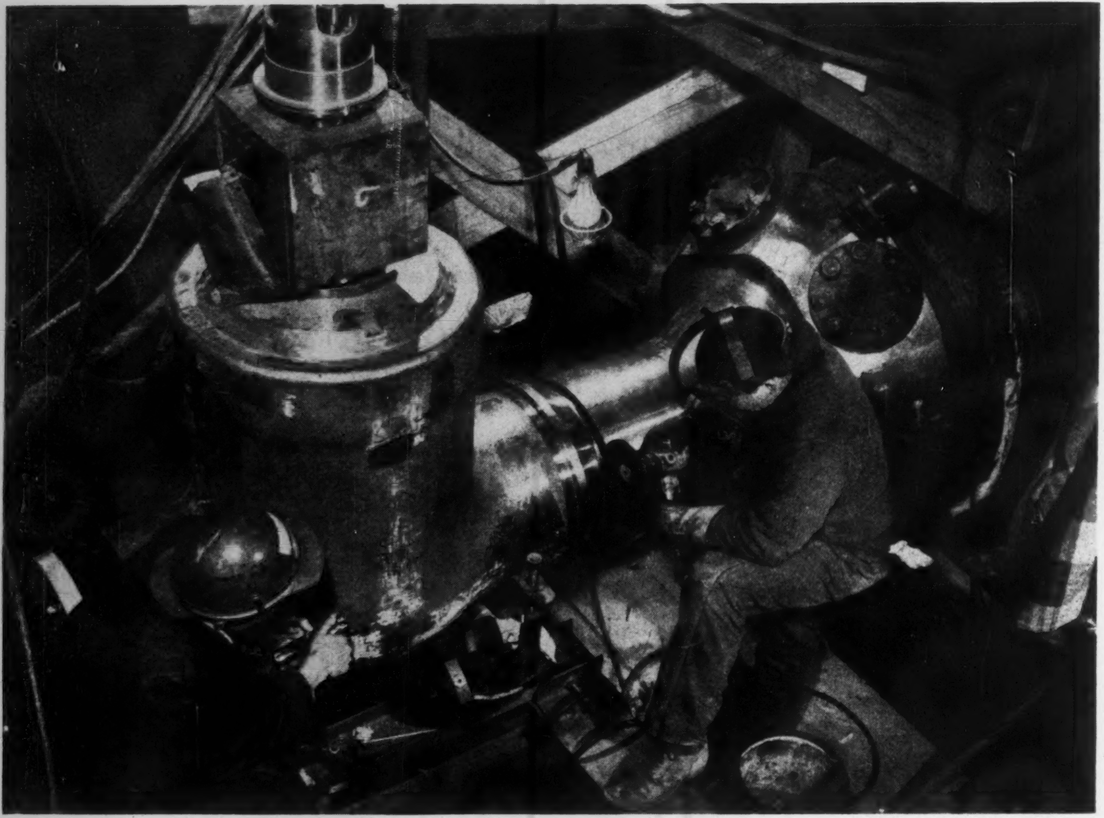
Liquid Metal Cooled Reactors

Sodium appears[3] to be a very non-corrosive substance. This is not true however of the product of a sodium-water reaction, which is sodium hydroxide. Evidence collected at several experimental installations indicates that sodium free of oxide is essentially inert to construction materials commonly found in high temperature systems. Corrosion loop tests[9] for the Fermi reactor indicated that Type 304 stainless steel and low alloy steels were adequate for their jobs. These tests also indicated that where low alloy steels of 2¼ percent chromium were used and temperatures were below 850 F, decarburization was



(Photo by Argonne National Laboratory)

TANK in lower right foreground serves the dual function of stripping water from reactor steam and acting as a heat exchanger for emergency use in removing shut down reactor heat from boiling water reactor. The tank and internals and primary steam piping to the tank are all stainless steel. All piping joints are welded



(Photo by Dravo Corporation)

VALVES for primary loop systems must be of same quality as the piping. Stainless steel stop valve at inlet to a heat exchanger in the primary loop of a pressurized water reactor power plant is shown here. Corrosion resistance and leak proofness are basic valve requirements. Reliability is also important because valves are operated remotely without inspection and are important in reactor safety

of no consequence. However, ferritic steels containing less than 5 percent chromium[8] decarburize to low levels in sodium systems which contain austenitic stainless steels.

Tests of stressed[9] and unstressed Type 304 stainless steel and 2¼ percent chromium, 1 percent molybdenum ferritic steel in static and dynamic sodium with up to 6 percent addition of sodium hydroxide have not shown any stress corrosion cracking.

In Case decision N-8, Type 304, 316, 321, 347, 348, 309 and 310 stainless steels are considered to comply with the rules of Section I of the Code for Nuclear Piping in plants handling sodium or sodium-potassium alloys. Responsibility for taking into account the decarburization that may occur rests with the designer. It should be noted that carbon removed from the piping in high temperature areas may be deposited at critical points in low temperature regions causing a restriction of the flow.

Intensive tests have shown[9] that galling and diffusion bonding of different materials can occur in sodium. Where undue pressures and high temperatures can exist, the use of hard surfaces is indicated. In the Fermi system, nitrided, stellited, or colmonoy surfaces are used under such conditions.

Use High Quality Valves

Valves for the primary loop system[6] must be of the same quality as the pipe. Corrosion resistance and leak proofness are the two basic requirements. Remote operation without benefit of inspection and importance of valve operation in reactor safety, stresses the need for reliability.

The bellows stem seal was developed for nuclear piping applications. Replacement of packing with bellows seals eliminates stem leakage. The bellows seal was initially developed for pressurized water reactors, but it is now being used[8] in liquid sodium cooled installations. The freeze seal, which employs a continuously shearing film of frozen sodium during valve operation, is also used in liquid metal systems. This latter seal is also used successfully in circulating pumps.

Consider Accessibility

The circulation of radioactive corrosion products has been referred to in earlier sections. The movement of these products and deposition in the system causes an undesirable buildup of radioactivity outside the reactor. This creates a dynamic shielding problem as well as limiting accessibility for maintenance purposes. The buildup of radioactivity is, of course, pronounced in stagnant areas, near crevices, and other zones in which the particles can settle.

Three rules set forth by W. L. Fleischmann,[11] as a result of experience at the Knolls Atomic Power Laboratory, to minimize localized accumulation of the corrosion products circulating in a system are as follows:

1) Minimize the number of dead end lines; when needed design a vertical takeoff from the top of the pipe; avoid bottom takeoffs.

2) Where a bottom drain is needed, have it plugged during operation so that the volume of dead space is minimized.

3) Avoid stagnant areas and pockets; where they occur provide separate means for draining and flushing.

Other Design Problems

Several areas to be considered in nuclear piping design have been discussed herein. There are others which must also be considered by the designer. As set forth[7] by J. A. Klapper, the specific considerations that must be accounted for in nuclear piping system design with minimum safety requirements in addition to those normally employed in a high-pressure steam line are:

1) The rapid temperature fluctuations which can result in severe thermal shock.

2) Interior surface finishes to prevent lodging of radioactive particles.

3) Quality control procedures that will insure reliability for the materials and the methods of component fabrication and erection.

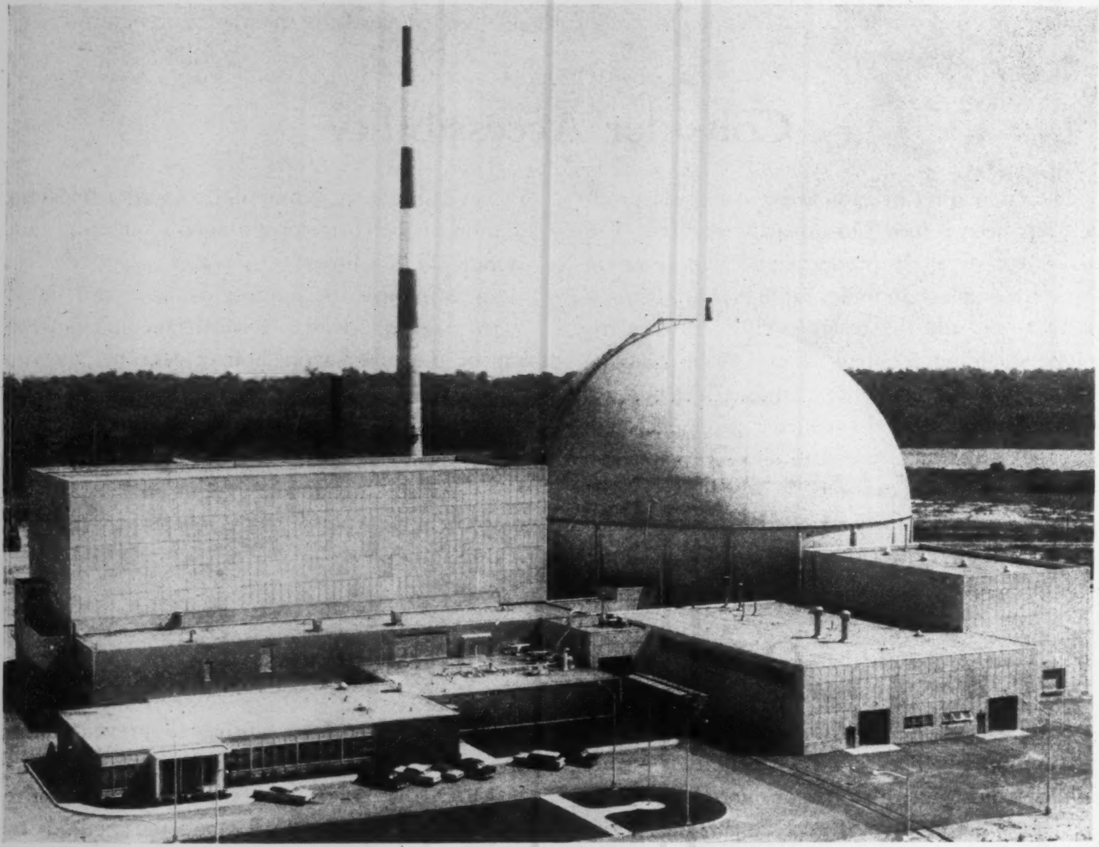
Nuclear piping designers and reactor operating organizations believe these three design-manufacturing considerations to be critical in the safe design and operation of nuclear reactor piping systems.

Design Considerations for Containment Shells

The ASME Boiler and Pressure Vessel Code is also employed in the design of nuclear power plants. This code is applied with some modification in the design of reactor vessels and of secondary containment shells when these are needed. Of most interest here is the secondary containment structure since the reactor vessel is an integral part of the reactor.

The basic requirement of the secondary containment shell is to prevent endangering the health and safety of the public as the result of an accident or failure in the nuclear portion of the power plant. Primary containment is, of course, constituted by the reactor vessel, pressure piping, and associated components. Should these rupture or leak radioactive materials into the atmosphere, the containment vessel prevents the escape of the hazardous products.

Various methods or concepts of containment have been used in existing plants and prototype plants. In most cases, to date, the containment shells have been steel spheres or cylinders. Owing to their high cost, other methods of containment are being searched out and investigated.



(Photo by Commonwealth Edison Co.)

DRESDEN NUCLEAR POWER STATION, which was recently dedicated, is the largest nuclear power station operating anywhere in the world, and is the nation's first privately-financed, full-scale atomic power plant. The plant, which serves the Commonwealth Edison Co. system, has a gross electrical output of 192,000 kw. Approximately 180,000 kw will be available for distribution.

The containment shell houses the dual-cycle boiling water reactor and its auxiliary nuclear steam supply system. The latter consists of the primary steam drum, emergency condenser, recirculating pumps, and secondary steam generators. The spherical structure which was designed and constructed in accord with the ASME Code for Unfired Pressure Vessels, is fabricated of welded steel plate varying in thickness from 1.25 to 1.4 in.

In the dual-cycle boiling reactor, water is boiled within the reactor core by fission heat and produces steam at 545 F. Water and steam are separated in the primary steam drum. The primary steam is piped to the turbines at a pressure of about 1000 psi. The hot water is used to generate secondary steam at 500 psi which is admitted to the turbine at a lower stage.

The nuclear steam supply piping was shop fabricated of stainless steel and shipped to the site as conventional spools. The individual spools were preassembled and erected in one piece to minimize the number of difficult placement weldments. To minimize radioactive contamination of the nuclear steam supply system and the turbine system, a high degree of cleanliness was required. All process systems were flushed with water, blown with steam, and then cleaned with chemicals. Hot citric acid was the major cleaning chemical.

The 300 foot high concrete stack is used to discharge ventilating air and process gases. Any radioactive gases are retarded until rendered harmless before being discharged from the stack.

Gas Tight Shells Common

The containment shells for water cooled reactors — the predominant full scale reactors at present in the U. S. — have been gas tight structures. Current design practice[12] in these plants is to provide sufficient strength in the shell to withstand the pressure rise that might occur from escape of steam and water through the maximum credible rupture in the primary coolant system. Although credit may be taken for some condensation of steam on walls and other surfaces if the magnitude of this effect can be predicted, no deliberate attempt has been made to increase the condensation effect in previous containment envelope designs.

Recently, a method of containment called "pressure suppression containment" has been studied[12] and considered for use with a boiling-water power reactor scheduled for operation in 1962. In this method of containment, the reactor is located in an air filled cylinder (dry-well) which is surrounded by a pool of water. Vent pipes connect the dry-well to the pool of water which in turn is enclosed in a vapor-tight container. A rupture or leak in the reactor will fill the dry well with an air-steam-water mixture which is discharged through the vent pipes to the pool through outlets below the water surface. In theory, the steam is condensed in the pool of water. If the condensation is rapid enough and relatively complete, the pressure build up in the vapor tight shell will be small. Additionally, the water will scrub solid particles from the vent gas that may be carried in the gas in the event of an accident in the piping system or reactor vessel. Several test installations have been built in order to investigate [12,13] this method of containment.

What are Containment Needs?

The containment requirements[14] for a specific type of power reactor plant are determined on the basis of pressure, temperature, and volume of radioactive gas or vapor due to a failure or accident resulting in the coolant and moderator (if a fluid) being released from the reactor vessel and associated systems — e.g. piping, heat exchangers, pumps, etc. The gas or vapor pressure, temperature, and volume containment conditions are a function of the potential stored thermal energy, chemical energy, and nuclear energy of the reactor and associated systems. One of the principal factors in determining the gas or vapor volume, pressure, and temperature containment requirement is the rate of energy release and production associated with the failure or accident.

Must Assess Maximum Energy Source

The problem[14] of evaluating the maximum potential energy source is a major factor in determining the type of containment and maximum size or volume of vapor. The "maximum credible accident" must be established for each plant. A generally accepted ground rule is to evaluate the maximum credible accident on the basis of two simultaneous failures. In pressurized water plants, this has been assumed to involve rupture of the primary coolant system piping, and in addition, the simultaneous rupture of the steam outlet pipe of one of the steam generator units. (A large power reactor plant of this type would probably have three or four steam generator units.)

Here Are Key Factors in Design

Containment vessels are designed and constructed in accordance with applicable codes, as modified to meet the requirements of nuclear power plant conditions. Some of the key factors according to R. H. Shannon[14] are:

1) Volume (free volume) and related pressure and temperature design conditions to satisfy maximum credible accident concept.

2) Field erection conditions.

3) Layout (arrangement of equipment to satisfy functional requirements); shielding; and foundations.

4) Internal pressures below atmospheric — internal vacuum condition.

5) Vessel penetrations, such as access doors for equipment and personnel, piping, electrical conduits, and instrument and control tubing.

6) Loads — other than that due to pressure and temperature such as dead loads, live

loads, and temporary load conditions especially during construction.

7) Vessel surface temperature differential.

8) Inspection and testing requirements including materials, fabrication, completed vessel, leak tests, use of temporary supports, (bracing or stiffeners), effects of temporary openings, and buoyancy or flotation problems.

9) External loads, including those from hurricanes and earthquakes.

As was noted earlier, the ASME Boiler and Pressure Vessel Code with modifications is used to design reactor and containment vessels. The modifications are made through case decisions. The principal decisions which apply for nuclear systems, as compiled by R. H. Shannon,[14], are listed in the table below.

Case Number	Subject
1218	Plate marking
1224 ; 1224-1	Code rules to be used in the design of nuclear vessels
1225	Safety devices for reactor vessels
1226 ; 1226-1 ; 1226 ;3	Stress relieving of containment vessels
1228	Erection of containment vessels in stages
1234	Special rules for nuclear reactor vessels
1235	Construction of containment vessels without pressure relief devices
1238	Intermediate containment vessels
1245	Use of rupture discs in nuclear systems

[*The editors gratefully acknowledge the cooperation of the engineers and organizations who permitted reference to their papers and who reviewed the report. The schematic diagrams of the various reactor piping arrangements were adapted from similar figures in the U. S. Atomic Energy Commission report SL*-1674.]

References

1) *Civilian Power Reactor Program, Part III, Status Report on Pressurized Water Reactors as of* 1959, United States Atomic Energy Commission, TID-8518 (2), Book 2 (1960).

2) *Civilian Power Reactor Program, Part III, Status Report on Boiling Water Reactor Technology as of* 1959, United States Atomic Energy Commission, TID-8518 (5), Book 5 (1960).

3) *Civilian Power Reactor Program, Status Report on Sodium Graphite Reactors as of* 1959, United States Atomic Energy Commission, TID-8518 (6), Book 6 (1960).

4) *Civilian Power Reactor Program, Part II, Economic Potential and Development Program as of* 1959, United States Atomic Energy Commission, TID-8517 (1960).

5) *Civilian Power Reactor Program, Part III, Status Report on Aqueous Homogeneous Reactors as of* 1959, United States Atomic Energy Commission, TID-8518 (3), Book 3 (1960).

6) Lubomirski, R. S. "Atomic Age Radiation Hazards Stiffen Safety Standards," Heating, Piping & Air Conditioning, Vol. 31, No. 1, 134-137 (1959).

7) Klapper, J. A., "Standardization of the Procedure to Qualify Materials for Nuclear Piping Systems," 6th Nuclear Engineering and Science Conference, April 1960.

8) "Piping Code Committee Interprets Nuclear Cases," Heating, Piping & Air Conditioning, Vol. 32, No. 4, 159-162 (1960).

9) *Civilian Power Reactor Program, Part III, Status Report on Fast Reactors as of* 1959, United States Atomic Energy Commission, TID-8518 (1), Book 1 (1960).

10) Malcolm, V. T., and Low, S., "What Can be Done to Combat Failures in Nuclear Piping?," Heating, Piping & Air Conditioning, Vol. 30, No. 6, 112-114 (1958).

11) Fleischmann, W. L., and Williams, S. L., "Engineering Approaches to Some Materials Problems of Nuclear Power Plants," 4th Nuclear Engineering and Science Conference, March 1958.

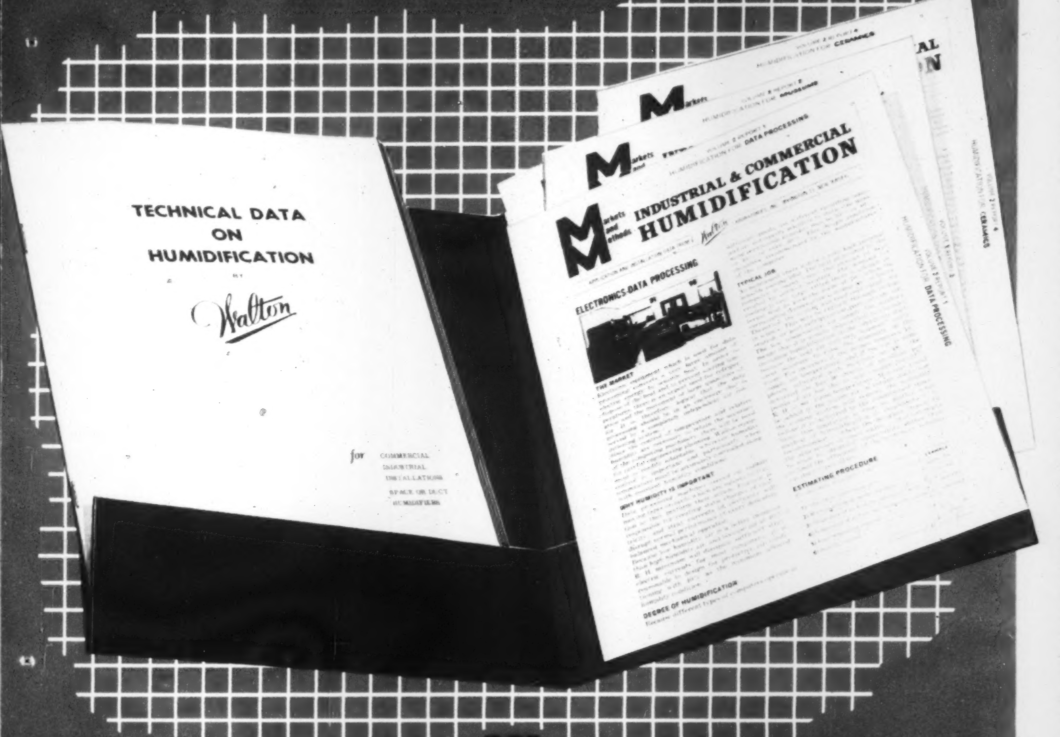
12) Power Reactor Technology, Vol. 3, No. 3, prepared for the United States Atomic Energy Commission by General Nuclear Engineering Corporation, June 1960.

13) Whelchel, C. C., and Robbins, C. H., "Pressure Suppression Containment for Nuclear Power Plants, American Society of Mechanical Engineers, Paper 59-A-215 (1959).

14) Shannon, R. H., "Nuclear Power Plant Safeguards and Containment," Proc. of the American Power Conference, Twenty-First Annual Meeting, Vol. XXI, 60-89 (1959).

Now... A Gold Mine of

TECHNICAL DATA


TECHNICAL DATA
ON
HUMIDIFICATION
BY
Walton
for COMMERCIAL
INDUSTRIAL
INSTALLATIONS
SPACE OR DUCT
HUMIDIFIERS
Markets and Methods
INDUSTRIAL & COMMERCIAL
HUMIDIFICATION
ELECTRONICS-DATA PROCESSING
HUMIDIFICATION FOR DATA PROCESSING
HUMIDIFICATION FOR CERAMICS

ON
COMMERCIAL & INDUSTRIAL
HUMIDIFICATION

MAJOR HUMIDIFICATION MARKETS

ABRASIVES
AGRONOMY
AIR CONDITIONING
ANIMAL REARING
ANTIQUES
APPLE STORAGE
ART GALLERIES
BAG MAKING
BAG STORAGE
BAKERIES
BELTING
BOWLING ALLEYS
BRAIDING
BREWERIES
CABINET MAKING
CANDY
CARPET
CARTONS
CELLOPHANE
CERAMICS
CEREALS
CIGARETTES
CIGARS
CONTAINERS (PAPER)
CORDAGE
COTTON
DECALS
EGG STORAGE
ELASTIC YARNS
ELECTRONIC COMPUTERS
ENVIROMTL. CHAMBERS
FILM PROCESSING
FILM STORAGE
FLORISTS
FOOD STORAGE
FRUIT STORAGE
FURNITURE
GLASS (LENSES)
GLOVES
GLUING
GREENHOUSES
HATCHERIES
HATS (FUR FELT)
HORTICULTURE
HOSIERY
HOSPITALS
INCUBATORS
KNITTING
LABELS
LABORATORIES
LACE
LEATHER
LETTER PRESS
LITHOGRAPHY
MEATS
MULLERS
MUSEUMS
PHARMACEUTICALS
PHOTOGRAPHY
PIPE ORGANS
PRINTING
RADIUM
RAYON
SILKS
SYNTHETICS
TAPES
TEXTILES
TOBACCO
WOOD
WOOL
X-RAY
YARN

... Available Without Charge to all Recognized Architects, Engineers and Contractors.

Here, in concise, accurate form is the information you need to cash in on this important and profitable phase of complete air conditioning . . . 16 pages of authentic information which will enable you to estimate the capacity, and then size and select equipment for more than 70 humidification applications.

FILL IN THIS REGISTRATION CARD AND MAIL TODAY
. . . Together With Your Card or Letterhead to:

Walton
Laboratories, Inc.
Irvington 11, New Jersey
Chicago Office: 548 W. Washington Blvd.

THE EQUIPMENT *AND THE EXPERIENCE*
FOR EVERY HUMIDIFICATION APPLICATION

Walton

Please send your free 16 page technical bulletin on industrial and commercial humidification plus monthly Markets and Methods Reports covering the latest developments in the field of humidification.

Name____________________________

Company____________________________

Address____________________________

City__________________ State__________

FRICK ACCEPTS COMPLETE RESPONSIBILITY

when we contract to install our air conditioning or refrigeration systems

When FRICK designs, manufactures and installs an air conditioning or refrigeration system of *any* size . . . *it works.* We guarantee that by written contract; no excuses, no alibis, no putting the blame on any component manufacturer.

Because of our complete and unique engineering service, the pride we take in our work and our 107 years of experience, we have . . . with the cooperation of architects, consultants, and contractors . . . designed, installed and *guaranteed* air conditioning and refrigeration systems of all types . . . for hotels, restaurants, stores, office buildings, hospitals, processing and industrial plants.

Write for estimates. Better yet, a FRICK engineer will be happy to discuss your problem with you. No obligation.

FRICK COMPANY
Waynesboro, Pennsylvania

TRADE FRICK MARK ®

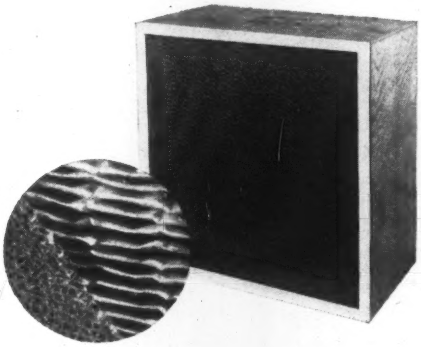
18 BRANCH OFFICES AND MORE THAN 150 DISTRIBUTORS THROUGHOUT THE WORLD

Mine Safety Appliances Company

201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

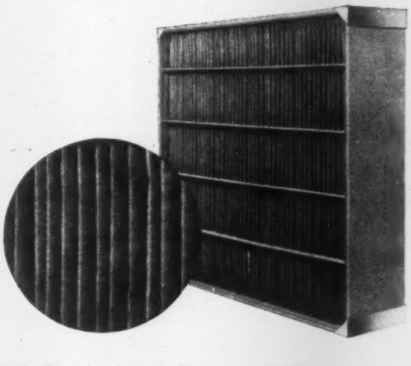
M S A:

Fluid Purification Equipment / Fluid Purification Specialists for 45 years



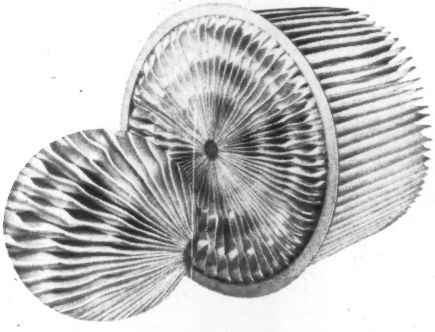
M-S-A® UltraAire* Space Filter

Lightweight, fire-resistant, unusually strong, and ideal for high humidity service. Individually pretested and proved at least 99.97% efficient in removing particles of 0.3 micron diameter.



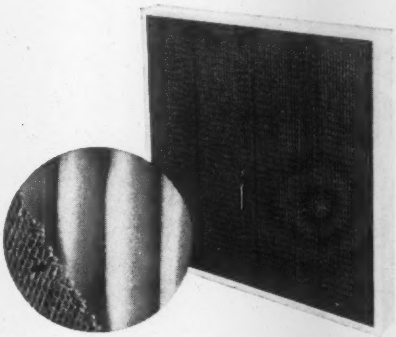
M-S-A® Dustfoe* Space Filter

Offers the efficiency of an Electrostatic Precipitator without the high cost and without the possibility of arcing "blow-off." 85-95% certified efficiency on NBS Atmospheric Air Dust Stain Rating.



M-S-A® Cylindrical-Type UltraAire* Space Filter

Honeycomb-type fold without separators is admirably suited to cylindrical element construction. This shape is preferred for pressure systems and round ducts. Easy to handle. Inexpensive to ship.



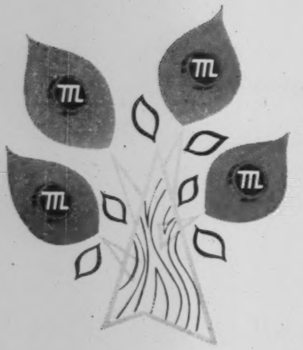
M-S-A® Air-O-Kay* PreFilter

Impingement type panel prefilter which can be used oiled or dry to remove lint and other large airborne particles from the atmosphere. 60-70% certified efficiency on NBS Stain Rating.

*Trademark

Write for illustrated technical bulletins on M-S-A Space Filters related to your particular system problem. Ask an MSA Representative for system recommendations. Mine Safety Appliances Company, Pittsburgh 8, Pa., Phone: CHurchill 1-5900.

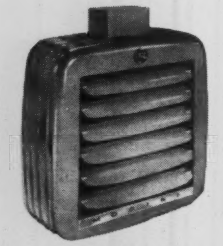
Other Fluid Purification Equipment includes catalytic filters for jet aircraft cabin air; air separation plants; inert gas generators; space capsules; bomb shelters; air line filters; jet fuel and hydraulic fluid purification.



NEW MEMBERS IN THE Modine

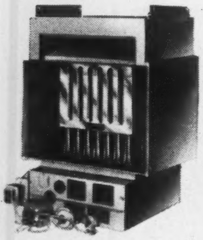
15 new reasons

WORLD'S MOST COMPLETE UNIT HEATER PACKAGE



NEW

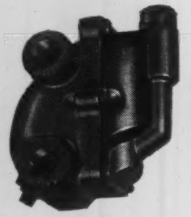
ELECTRIC UNITS — as dependable as your electric power source! Seven sizes — 17,065 to 85,325 Btu. Catalog 1060.



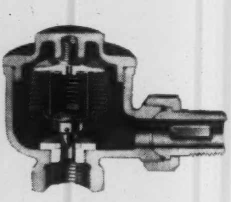
NEW

GAS-FIRED DUCT FURNACES — now AGA-approved for installation *downstream* from refrigeration systems. Six sizes — 75,000- to 300,000-Btu/hr input. Catalog 659B.

A COMPLETE NEW STEAM SPECIALTIES PACKAGE

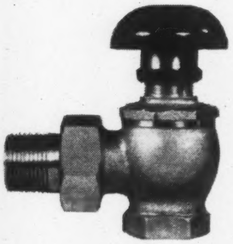


DRIP TRAPS



THERMOSTATIC TRAPS

STRAINERS



RADIATOR SUPPLY VALVES

A COMPLETE RADIATION PACKAGE

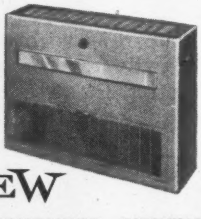
NEW

BASEBOARD HEATING — for steam and hot water. Perimeter heating at its best. Two sizes — 9½" and 11¾" high. For full details see Bulletin 360.

A COMPLETE ROOM AIRDITIONER PACKAGE

NEW

LOW-BOY AIRDITIONERS®—14½" low, utilize central-source chilled water for cooling and steam or hot water for heating. Amazingly compact and quiet. Four sizes. Bulletin 760-B. Also other models: Bulletin 757.

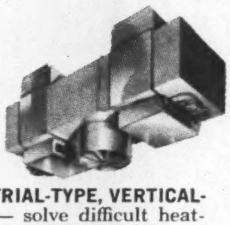


NEW

SELF-CONTAINED AIRDITIONERS — heat with steam, hot water from a central source or with electricity. Cool with self-contained refrigeration unit. Four models. Bulletin 760.

FAMILY OF QUALITY PRODUCTS ADD UP TO . . .

for specifying Modine



NEW

GAS-FIRED, INDUSTRIAL-TYPE, VERTICAL-DELIVERY UNITS — solve difficult heating problems in large commercial and industrial buildings. Three sizes — 300,000- to 600,000-Btu/hr input. Catalog 660.

Other Modine unit heaters:

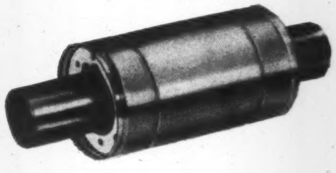
Steam and Hot Water Units — horizontal, vertical and Power-Throw types . . . wide range of sizes. Catalog 159.

Steam and Hot Water Blower Units — for large-volume air-handling applications. Five types, eight models. From 600 to 33,000 cfm. Bulletin 858.

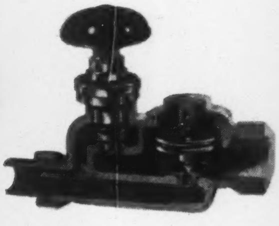
Gas-Fired Propeller Units — attractive, lightweight. Stainless steel burners. Eight sizes — 25,000 to 310,000 Btu. Catalog GU660.

Gas-Fired Blower Units — for heating and ventilating. Seven models from 50,000 to 310,000 Btu. Catalog GB660.

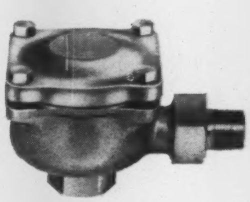
LIFT FITTINGS



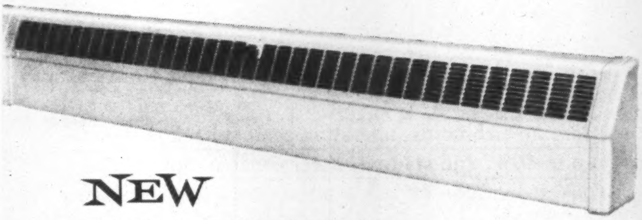
EXPANSION JOINTS



DOUBLE-SERVICE VALVES



PROCESS STEAM TRAPS



NEW

FINNED TUBE RADIATION — for steam and hot water. Simplified design speeds installation, reduces cost. Two enclosure styles. Full details given in Bulletin 460.

Other Modine radiation units:

Standard Convectors — 30 types and 8,000 sizes. Choice of standard and heavy-gauge enclosures. Catalog 257.

Cabinet Units — eight enclosure types — 120 to 640 Edr. Catalog 557.

Heating and Ventilating Units — in five types, eight models . . . in sizes from 600 to 33,000 cfm. Bulletin 858.

Perma-Trim Wall-to-Wall Convectors — in two types; offer the finest in convector comfort. Full facts in Bulletin 259-A.

UR-1423A

Expansion program greatly increases Modine's application range

With the array of fine new products above, Modine is better qualified than ever to fill the year-round comfort requirements of industrial, commercial, institutional and residential buildings. And every product meets Modine's well-known high standards of design, construction and performance excellence. Through long years of experience, Modine has found that strict adherence to these quality standards is the *only* way to achieve *complete customer satisfaction.*

Note the bulletin numbers of products you're interested in and contact your nearest Modine representative . . . he's listed in the yellow pages. Or write Modine Manufacturing Co., 1509 DeKoven Ave., Racine, Wis.

Modine®

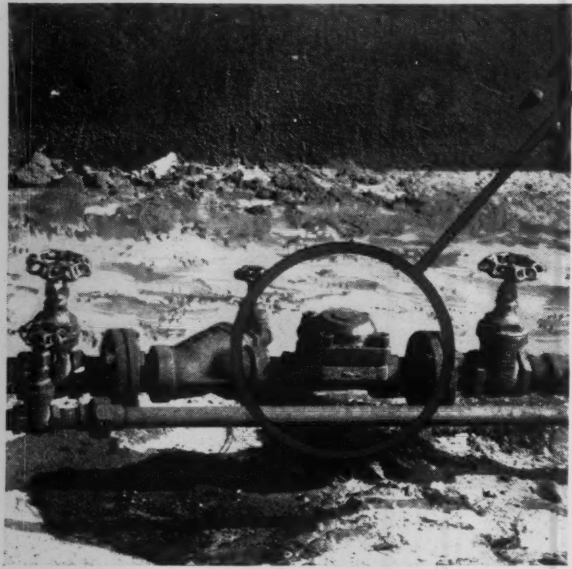
MANUFACTURING COMPANY

In Canada: Sarco Canada, Ltd., Toronto 8, Ontario

YARWAY Y news briefs

from **Yarnall-Waring Company,** *Philadelphia 18, Pa.*

BRANCH OFFICES IN 19 UNITED STATES CITIES • SALES REPRESENTATIVES THROUGHOUT THE WORLD • STEAM TRAPS STOCKED AND SOLD BY 270 LOCAL INDUSTRIAL DISTRIBUTORS



THIS STEAM TRAP WILL DISCHARGE 25,500 LBS. OF CONDENSATE PER HOUR

This is a typical installation of a Yarway Series 40 Impulse Steam Trap—a trap designed specifically to gobble up extra heavy condensate loads.

The trap is a No. 48, 2½" size, and is installed on a suction heater connected with an 86,000 barrel tank containing fuel oil at a storage terminal. The operating pressure is 13 psi. At this pressure the trap has a capacity of 25,500 lbs. continuous discharge of condensate per hour.

At operating pressure of 100 psi, the trap's capacity is 62,000 lbs. per hour.

CAPACITY—PLUS

Capacity isn't the whole story on Yarway Series 40 Steam Traps. Like all Yarway Impulse Traps, they offer advantages like quick heat-up, even temperatures, small size, good for all pressures, non-freezing.

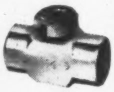
Series 40 traps also feature high temperature discharge characteristics, excellent low pressure operation, no airbinding, operation against back pressures up to 40%, and stainless steel construction.

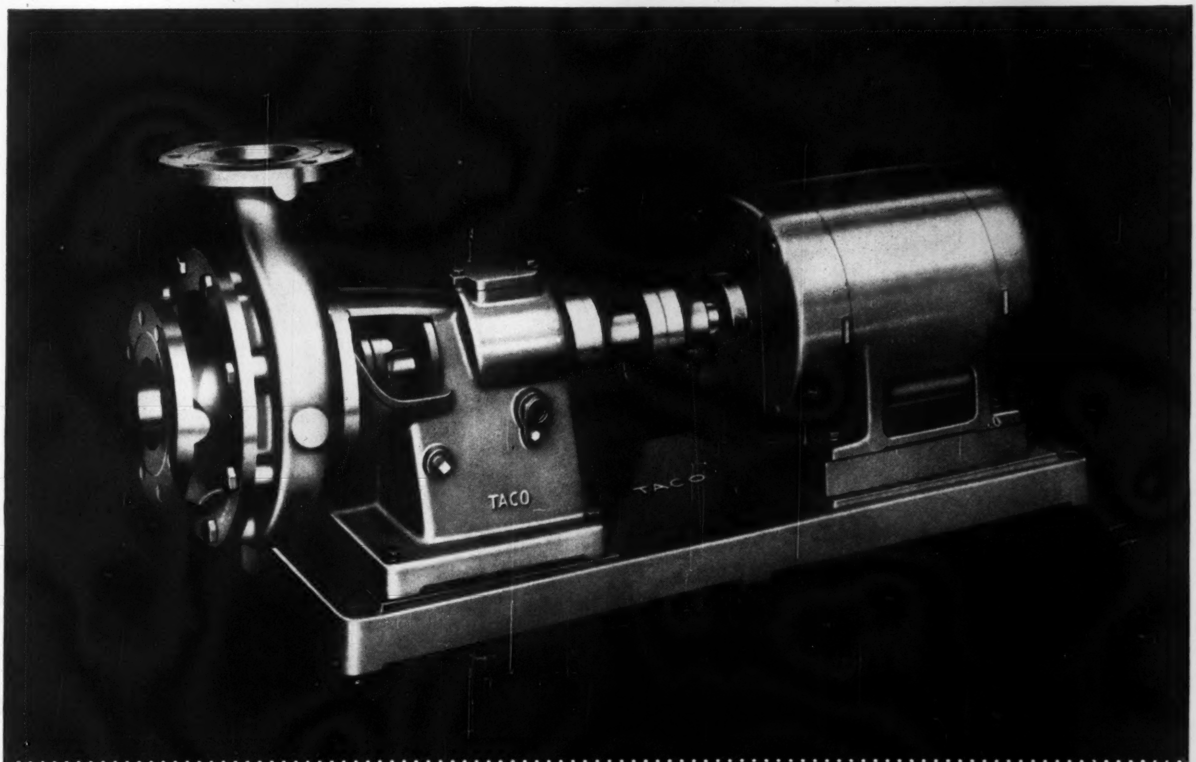
You can get Yarway's latest steam trap Bulletin T-1743, or arrange for a free 60-day trial of a Yarway Impulse Trap, by writing to Yarnall-Waring Company or contacting your local Industrial Distributor.

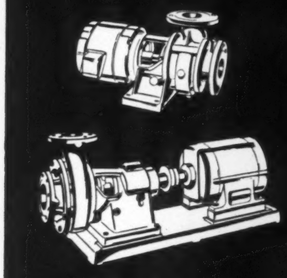
NO. 40
YARWAY
HIGH CAPACITY
IMPULSE STEAM TRAP
MAX. PRESS. 600

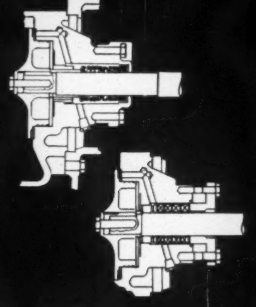
Yarway ½" No. 40 Impulse Steam Trap (shown actual size). Also available in ¾", 1½", 2" and 2½" sizes.

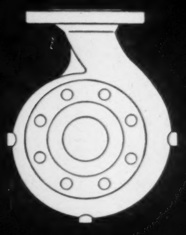
YARWAY OFFERS IMPULSE STEAM TRAPS FOR THESE SPECIFIC OPERATING CONDITIONS

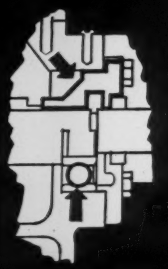
AVERAGE CONDENSATE LOADS	EXTRA HEAVY CONDENSATE LOADS	LIGHT CONDENSATE LOADS
		
Series 60	Series 40	No. 30




Close-Coupled
or Base-Mounted


Seals or Stuffing Boxes


Centerline Discharge


Sleeve or Ball
Bearing Frames

How to please everybody... well almost!

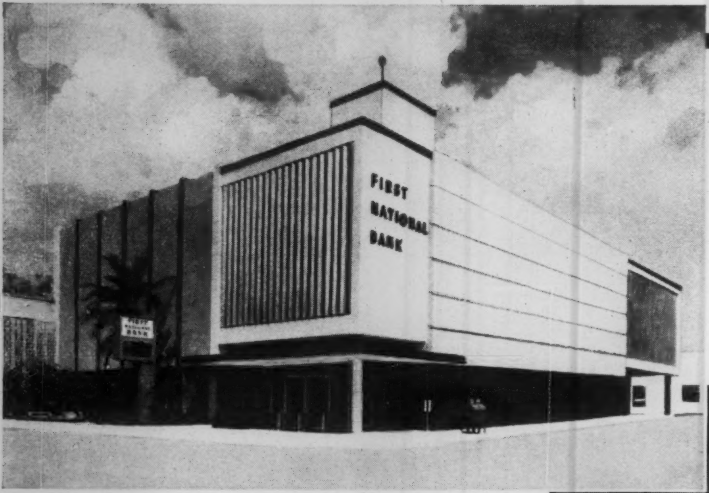
It's a cinch you can't please *all* users of centrifugal pumps with *any* single line of pumps. But the TACO "LP" does give an awful lot of heating engineers precisely the pump performance they need.

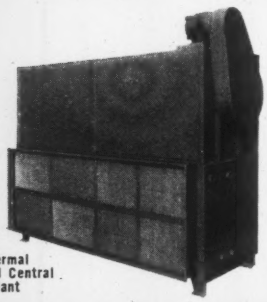
The reason is *extras* . . . extra design features which make an "LP" more versatile, more efficient, more dependable. For example, it's available close-coupled or base-mounted . . . with sleeve or ball bearing frame . . . extra quiet motor . . . mechanical seals or stuffing boxes. It's an *advanced-design* pump too . . . with self-venting centerline discharge . . . casings adaptable to horizontal discharge. And . . . it's a *top quality* pump . . . with stainless steel shaft sleeves . . . oil slinger lubrication . . . permanently located throttle bushing.

For *your* next installation, pick your pump from the line with the extras . . . "LP". TACO also manufactures a line of high head pumps and circulators. Write TACO HEATERS, INCORPORATED, 1160 Cranston St., Cranston 9, Rhode Island.

TACO

SERVING THE HYDRONIC INDUSTRY SINCE 1920

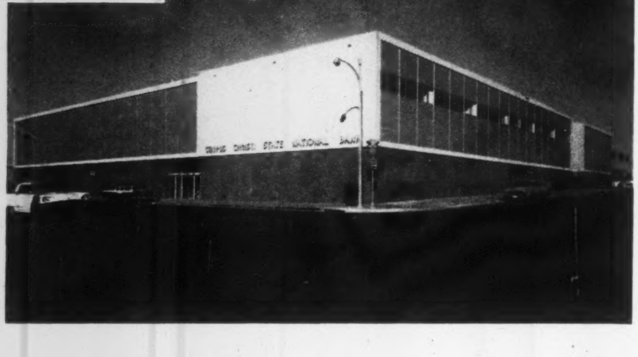




Thermal
Vertical Central
Plant

First National Bank, Fort Myers, Florida

Corpus Christi State National Bank, Corpus Christi, Texas



Satisfaction with THERMAL that can't be discounted

Numerous Bank Buildings Depend on Thermal for Comfort

As the reputation for quality and dependability of Thermal air conditioning and ventilating equipment becomes known, more and more banks, as well as all other types of buildings, are using Thermal.

This is equipment with quality to give satisfaction and long life. Design features combine ready accessibility of internal components with rugged construction.

For further details on air conditioning and ventilating equipment you can specify with confidence, write for complete catalog and names of nationally known concerns using Thermal. The Thermal line includes central and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers.

Here are **some** of the banks using Thermal equipment:

East Lake Branch of Birmingham Trust National Bank, Birmingham, Ala.
Commercial Bank, Andalusia, Ala.
Commercial National Bank, Daytona Beach, Fla.
First National Bank, Ft. Lauderdale, Fla.
Dade National Bank, Miami, Florida
Florida National Bank at Brent, Pensacola, Fla.
First Federal Savings & Loan Bldg., Hattiesburg, Miss.
East Central Branch, Bank of New Mexico, Albuquerque, New Mexico
Bank of Broken Arrow, Broken Arrow, Oklahoma
First National Bank, Muskogee, Oklahoma
First National Bank, Abilene, Texas
First Savings & Loan Bldg., Corpus Christi, Texas
Austin Savings & Loan Co., Austin, Texas
North Austin State Bank, Austin, Texas
Security State Bank, Beaumont, Texas
American National Bank, Beaumont, Texas
Farm-Home Savings & Loan Bldg., Ft. Worth, Texas
Raymondville State Bank, Raymondville, Texas
First National Bank, Rockport, Texas
Bellaire State Bank, Bellaire, Texas
Lockhart Savings & Loan Bldg., Lockhart, Texas
First National Bank, Giddings, Texas
Grove State Bank, Dallas, Texas
San Jacinto State Bank, Houston, Texas
First National Bank, Refugio, Texas
Tyler Bank & Trust Co., Tyler, Texas

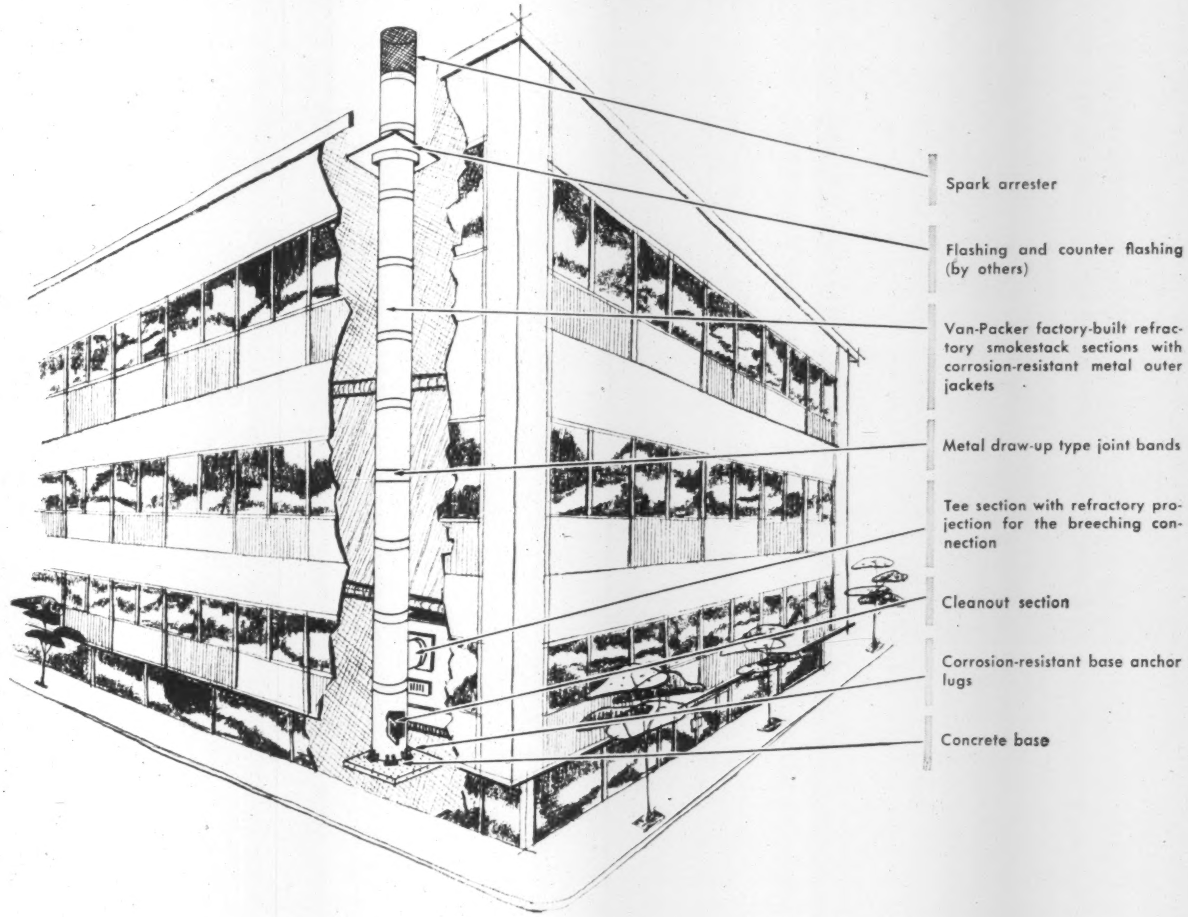
Quality Products Since 1945

**THERMAL ENGINEERING
CORPORATION**

2605 W. DALLAS • P. O. BOX 13254
HOUSTON 19, TEXAS

AGENTS IN PRINCIPAL CITIES

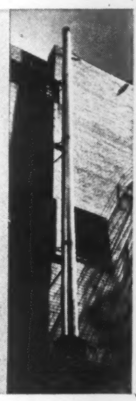
Flintkote • Van-Packer factory-built refractory smokestack simplifies stack location problems


Spark arrester
Flashing and counter flashing (by others)
Van-Packer factory-built refractory smokestack sections with corrosion-resistant metal outer jackets
Metal draw-up type joint bands
Tee section with refractory projection for the breeching connection
Cleanout section
Corrosion-resistant base anchor lugs
Concrete base

Van-Packer smokestacks are 3-foot modular, factory-built refractory sections encased in a corrosion-resistant metal outer jacket. They require no painting or routine maintenance, which means your architectural designs can be made with minimum provision for smokestack accessibility. In many cases, this simplifies design requirements and makes possible greater flexibility, and more pleasing architectural effects.

Van-Packer Model HT Smokestacks are the *only* smokestacks listed under the Factory Inspection and Label Service Program of Underwriters' Laboratories, Inc., for use with boilers and incinerators. Available in 10", 12", 15", 18", 21", 24", 30", and 36" inner diameters. Mail coupon for full information.

FLINTKOTE
VAN-PACKER®
Division of The Flintkote Company
Manufacturers of Diversified Products for Home and Industry
30 Rockefeller Plaza, New York 20, N. Y.
Phone: PLaza 7-5500
In the West:
Pioneer Division, The Flintkote Company
P. O. Box 2218, Terminal Annex, Los Angeles, Calif.
In Toronto, Ontario:
The Flintkote Company of Canada, Ltd.



The Flintkote Company
Van-Packer Division
30 Rockefeller Plaza
New York 20, New York

Please send Bulletin IS-40 containing complete information and engineering data on Van-Packer Smokestacks.

My name ______

Firm ______

Address ______

City ______ Zone ______ State ______

QUIET

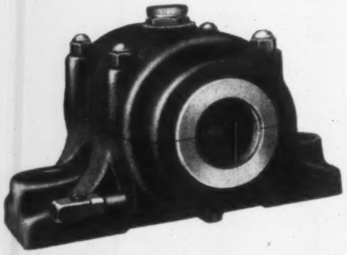
These quality bearings have been developed in close cooperation with manufacturers of fan and blower equipment — to meet the highly specialized requirements of this field.

The nation's great generating plants choose these bearings because of their extraordinary dependability—and the extreme quietness of their operation makes them top choice for air conditioning systems in hospitals, schools, theatres, auditoriums.

Dodge Fan and Blower Bearings are available from stock—with stock-product economy. Consult your local Dodge Distributor—or write us for technical data.

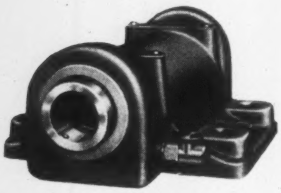
DODGE MANUFACTURING CORPORATION
1600 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.



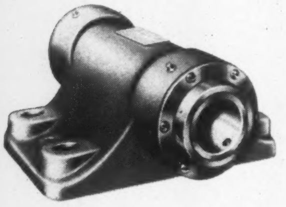
DODGE SLEEVOIL PILLOW BLOCKS

Exceptionally quiet in operation. Noted for superb quality. Plain and Water Cooled Types. Precision-built, ring-oiling, babbitted. Self-aligning. Can be drilled for thermostatic emergency warning. Shaft sizes from 1-7/16" to 10".



DODGE BRONZE BUSHED PILLOW BLOCKS

Designed for Arrangement No. 2 installations. Two bronze bushings of high lead content mounted in one cast iron housing. Special T-section rings for dependable lubrication. Exceptionally quiet in operation. Shaft sizes from 15/16" to 2-3/16".

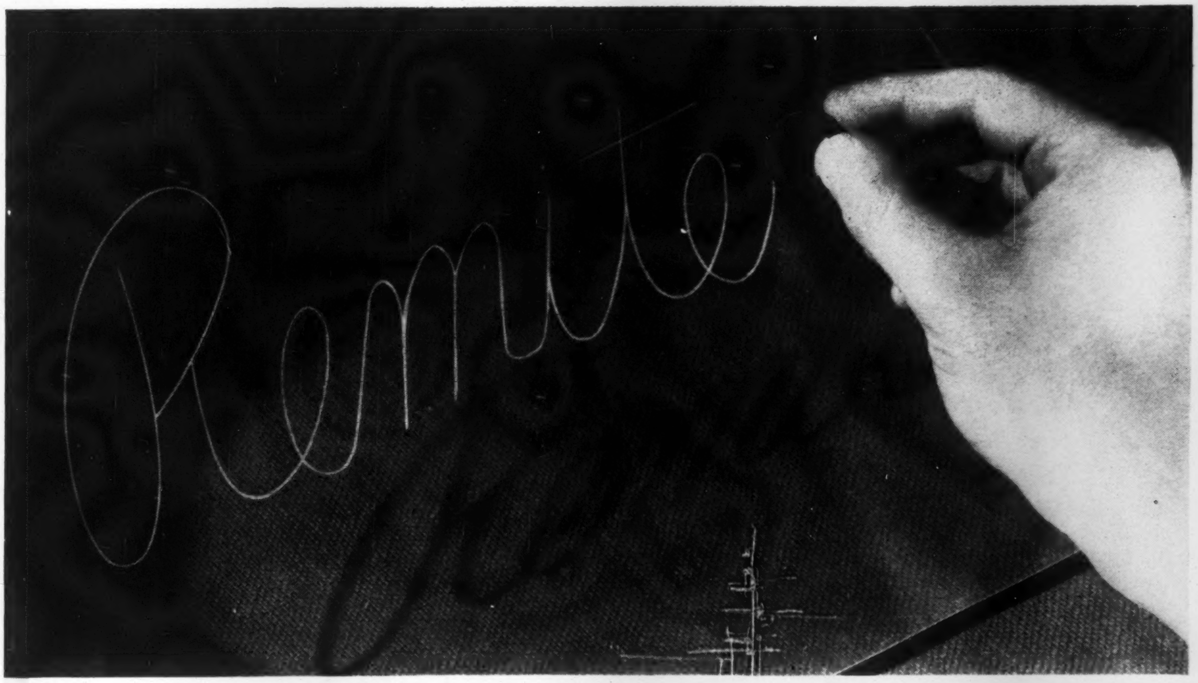


DODGE BALL BEARING PILLOW BLOCKS

Designed for Arrangement No. 2 installations. Two precision single row, deep groove ball bearings in one cast iron housing. Extended inner race carries shaft. Remarkable ease of installation and maintenance. Shaft sizes from 15/16" to 2-3/16".

MANUFACTURER OF AMERICA'S MOST COMPLETE LINE OF MOUNTED BEARINGS

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the white pages of your telephone directory, or in the yellow pages under "Power Transmission Equipment."

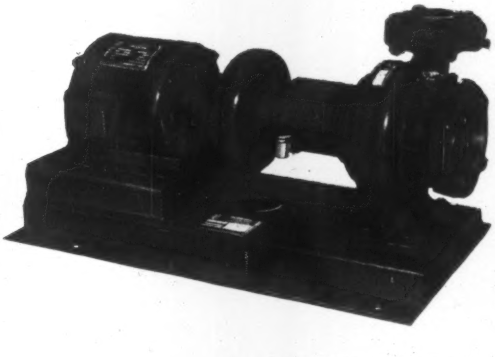


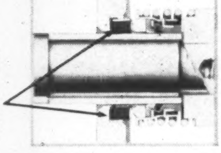
How the REMITE® seal in
B&G® centrifugal pumps
assures leak-proof operation

A new material, called "Remite," developed in the Research Laboratory of the Bell & Gossett Company, simplifies the problem of keeping water out of the bearings of centrifugal pumps.

"Remite" is almost diamond-hard...easily cuts glass... corrosion-resistant as well as wear-proof. In all B&G Universal and industrial pumps it is used as a floating seat facing a carbon seal. This unique combination eliminates pump leakage and gives trouble-free service even when the pumped liquid contains foreign material.

"Remite" is also produced commercially for a wide variety of applications where hardness and wearing qualities are important. It has high flexural strength and has corrosion-resistant qualities against a large number of chemical fluids. Electrical insulating properties are good at both high and low frequencies.





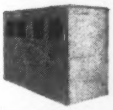
Position of "Remite" Seal as used in B&G Universal Pump—a unit built specifically for use in forced hot water heating systems and noted for quiet operation.

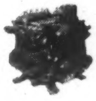
BELL & GOSSETT
COMPANY
Dept. GK-5, Morton Grove, Ill.

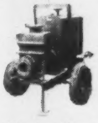
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ont.

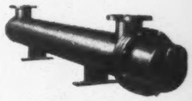
A DIVERSIFIED LINE OF HIGHEST QUALITY PRODUCTS

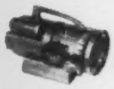
Booster Pumps


Package Liquid Coolers

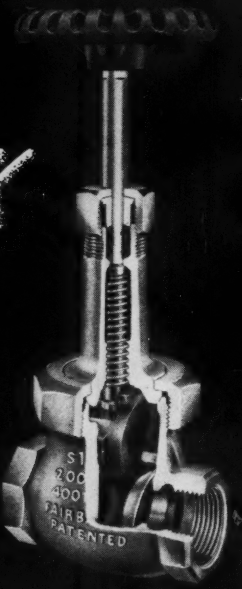

Refrigeration Compressors


Marlow Pumps

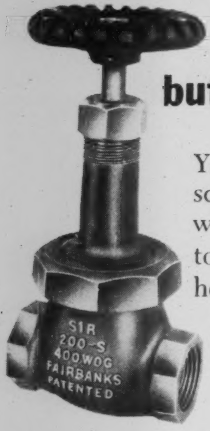

Heat Exchangers


Oil-less Air Compressors

MAYBE HORSES THINK SEAT RINGS NEVER NEED REPLACING...



but what do horses know about valves?



You know from bitter experience that when pipe chips, boiler scale or other hard particles catch between wedge and seat, the wedge will be damaged and the seat will be scored. You have to replace both wedge and seat or dump the valve. And no horse can tell you different!

But, if you've installed FAIRBANKS RENEWABLE SEAT RING GATE VALVES, you kiss down-time goodbye.
(PATENTED)

Because a set of seat rings and a screw driver puts a "new" gate valve on your line in minutes. And, you don't ever remove the valve body from the line!

That's why it's so important to you to know that no other valve in the world looks like this when you remove the bonnet. No other gate valve gives you such savings in down-time, maintenance time and inventory costs.

Yours on Request: Informative, colorful brochure giving complete facts about Fairbanks Renewable Seat Ring Gate Valves. Write without obligation.

THE **Fairbanks** COMPANY
Executive Office: 393 Lafayette Street, New York 3, N. Y.

520 Atlantic Avenue
Boston 10, Mass.

2600 S. Throop Street
Chicago 8, Ill.

393 Lafayette Street
New York 3, N. Y.

15 Stanwix Street
Pittsburgh 22, Pa.

202 Division Street
Rome, Georgia

FACTORIES: Binghamton, N. Y. and Rome, Ga.

A.
B.
C.
HERE'S WHY
WITCOLITE®
INSULATES
UNDERGROUND
HOT (OR COLD)
PIPELINES
BEST

Diagrammatic cross section of pipeline insulated with Witcolite.®

Witcolite is a granulated, resilient adhesive material which is easily installed. After curing, three zones of insulation are formed:
A) cured zone—insulating and anticorrosive area locked around pipe. **B) sintered zone**—air-pocketed insulating area...moisture barrier. **C) granular zone**—loose particles providing maximum thermal insulation.

WITCOLITE OFFERS ALL THESE ADVANTAGES

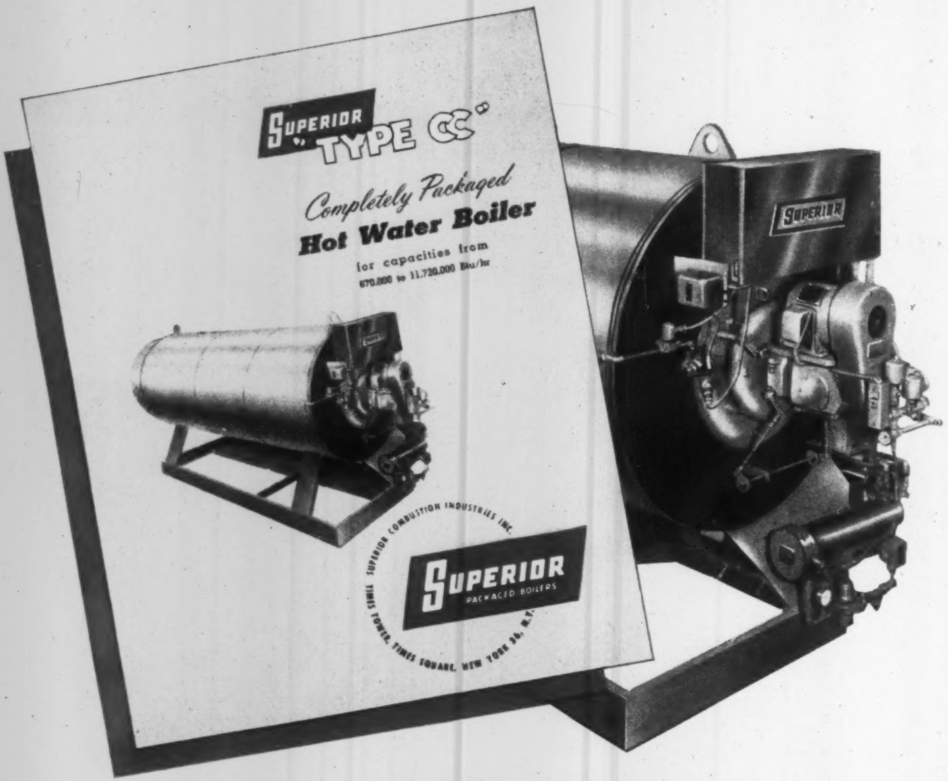
3 LABORATORY-CONTROLLED GRADES of granulated particle size assure perfect high thermal insulation of underground hot pipes...even with pipes alternately conveying hot and cold liquids. **HIGH THERMAL INSULATION** is the result of Witcolite's three zone protection. The product resists physical breakdown and adheres resiliently to pipes as they expand and contract with temperature changes. **HIGH CORROSION RESISTANCE** protects pipes permanently against acids and alkalis found underground. Witcolite is also effective against electrolytic processes. **HIGH WATER RESISTANCE,** results from the surface tension differential between water and Witcolite. No wetting of the underlying surface occurs. **LOWEST COST** of any quality material on an installed basis is an extra plus with Witcolite. *For further information or technical literature on Witcolite, simply write or call the nearest Witco office listed below for your local representative's address.*

Witcolite is delivered to your job site in convenient, easily handled 50 pound multi-wall paper bags.

WITCO CHEMICAL COMPANY, Inc.
PIONEER PRODUCTS DIVISION
Dept. 81-01, 122 East 42nd Street, New York 17, N.Y.

SEE OUR CATALOG IN SWEET'S

Sales offices: New York • Chicago • Los Angeles • Toronto and Montreal, Canada



SUPERIOR "TYPE CC"

Completely Packaged

Hot Water Boiler

for capacities from 670,000 to 11,720,000 Btu/hr

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR PACKAGED BOILERS

this catalog...will show you why

Specifically designed for HOT WATER operation ... with all these features:

- Venturi-Action Mixing-Tube
- 4-Pass Down-Draft Design
- Built-in Induced Draft
- Fires Gas Oil or Both
- Fully Automatic
- Hinged or Davited Doors
- Insulated and Jacketed
- Factory-fire-tested
- Complete package with undivided responsibility

For sizes to 11,720,000 Btu's/hr., write for catalog CCW-14
For sizes to 20,100,000 Btu's/hr., write for catalog CC-14

SUPERIOR "TYPE CC"

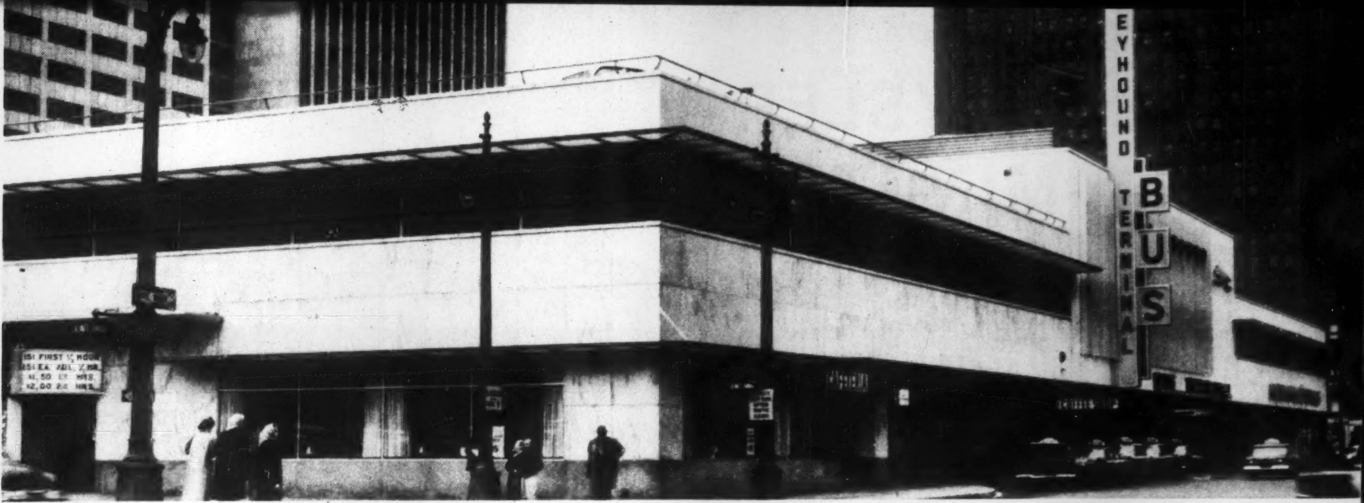
Completely Packaged

HOT WATER BOILERS are best... for hot water heating

Specialists in PACKAGED BOILERS... exclusively

SUPERIOR COMBUSTION INDUSTRIES, INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
PACKAGED BOILERS ®



Spang Steel Pipe provides all piping services in Detroit's new $4,500,000 Greyhound Bus Terminal.

SPANG® Steel Pipe uniformity pays off in Greyhound Terminal Installation

All the steam heating, air conditioning, plumbing, natural gas and storm drainage facilities in Detroit's new Greyhound Bus Terminal Building are serviced by SPANG Steel Pipe in sizes ranging from ¾" to 8". SPANG offered many advantages during installation. Listen to what Vice President George H. Whybrew of James & Roach, mechanical contractors, said about it.

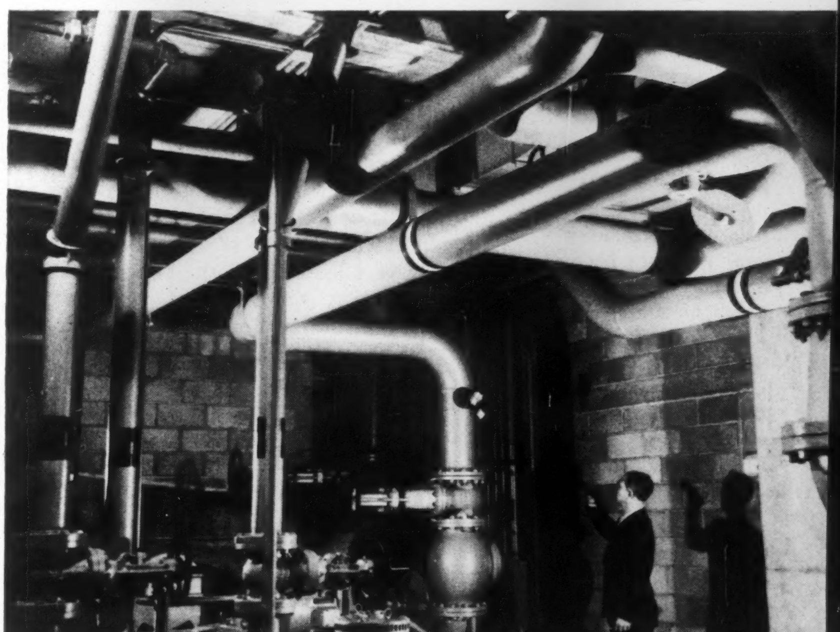
REPORT FROM MECHANICAL CONTRACTOR

"We had excellent delivery service on SPANG, getting what we needed when we needed it with no delay. And we got a good product. Our pipe had been hydrostatically tested at pressures many times our highest requirements.

"On actual installation, the consistent uniformity of SPANG Pipe was important in saving us time. We had some severe bends to do, but the pipe held up beautifully—no kinking, flaking or cracking. End cuts and bevels were true, and welding was no problem. In exposed locations, the smooth exterior finish painted nicely and made a good appearance. Yes, I'd recommend SPANG without hesitation on the basis of this job alone!"

GET DEPENDABLE PERFORMANCE WITH SPANG

Mr. Whybrew is just one of many contractors who know they can count on SPANG's uniformity for top-quality installations. SPANG can help you, too. Next job, be sure to ask for SPANG Steel Pipe . . . made in U.S.A. Call your nearby SPANG Distributor for service.



Steel

Steel's Symbol of strength, long life, and economy

In exposed locations, Spang's smooth exterior provides neat appearance. Spang Pipe uniformity and good service helped speed this job's construction.

SPANG
CW
STEEL PIPE

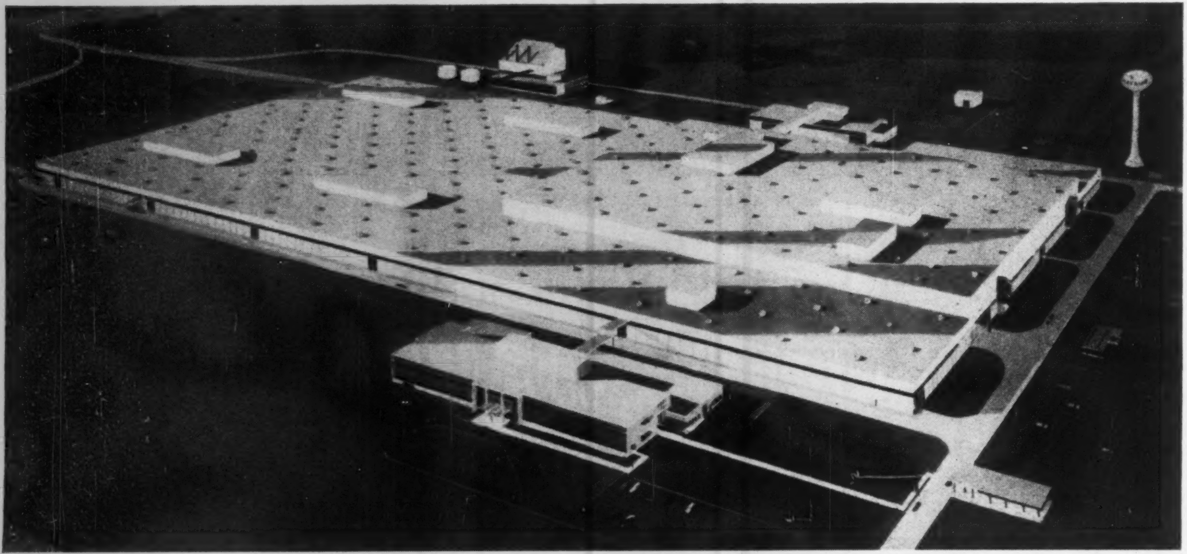
THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania
Subsidiary of Armco Steel Corporation

ARMCO

Owner: Eastern Greyhound Lines, Division of the Greyhound Corporation, Cleveland, Ohio
Architect: Arrasmith and Tyler, Louisville, Kentucky
General Contractor: Bryant and Detwiler, Detroit 26, Michigan
Mechanical Contractor: James & Roach, Detroit, Michigan
Engineer: Southern Engineering Corporation, Louisville, Ky.
Spang Distributor: O'Connell Supply Company, Dearborn Mic

NEW CHRYSLER CAR-A-MINUTE ASSEMBLY PLANT



ADMINISTRATION BLDG. — *Architects and Engineers:* SVERDRUP & PARCEL, St. Louis • *General Contractor:* FRUIN-COLNON CONTRACTING CO., St. Louis
ASSEMBLY BLDG. — ALBERT KAHN, *Associated Architects and Engineers,* Detroit • H. D. TOUSLEY CO., *General Contractor,* Kirkwood, Mo.
Mechanical Contractor: THOS. J. SHEEHAN CO., ST. LOUIS, MO.

Designed to hold down upkeep... equipped with JENKINS VALVES

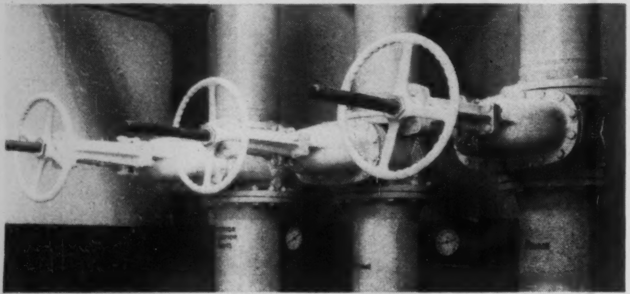
Chrysler Corporation's St. Louis assembly plant serves the midwest, employs more than 4000 in building Valiant, Plymouth, Dodge Dart and new Dodge Lancer cars. Seven buildings include a 1.3 million square-foot manufacturing building and a U-shaped administration building of reinforced concrete columns and girders, with pre-cast concrete floor and roof deck.

Designed to be "the nation's most modern automobile manufacturing facility," this huge new plant also represents an all-out effort to make it a record-breaker in terms of low upkeep.

That Jenkins Valves would minimize valve maintenance and replacement costs was assured by the service records of Jenkins Valves in other Chrysler Corporation plants.

By installing Jenkins Valves to control customary service lines and the extensive paint carrying system in the St. Louis plant, Chrysler guaranteed dependability and economy. Yet, the Jenkins Valves cost no more.

You can take the gamble out of valve costs with one word in your specifications or purchase order . . . the word for economy: "JENKINS." For information about specific valves, ask your local Jenkins Distributor or write—Jenkins Bros., 100 Park Ave., New York 17.



Jenkins Gate Valves control lines carrying paint as well as plumbing, heating, air conditioning.

JENKINS VALVES

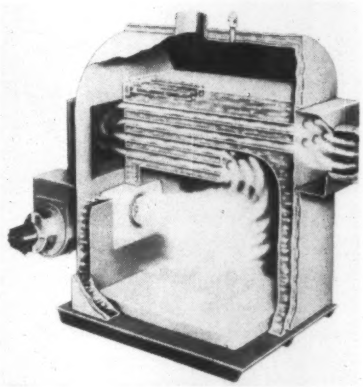
LOOK FOR THE JENKINS DIAMOND

JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Distributors Everywhere

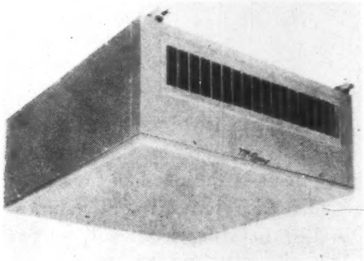
EQUIPMENT DEVELOPMENTS

Information on capacities, dimensions, applications, and special features in each item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details. For reviews of Recent Trade Literature see page 233



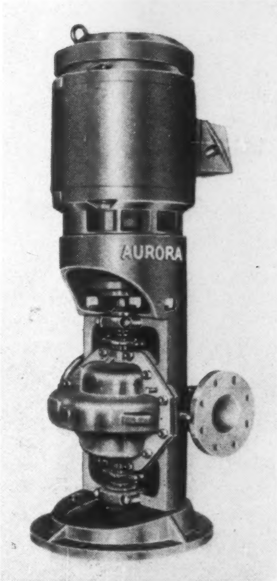
Steam Generators . . .

. . .for commercial and light industrial use. Three-pass low pressure steam or hot water firebox unit employs principles of sealed combustion and forced draft. Fired by oil, gas, or oil-gas. Steam or hot water ratings 355,000 to 2,009,000 Btu, or from 10.6 to 60 hp. Series "33" designed for 15 psi steam or 30 psi water. *Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland 11, O.*



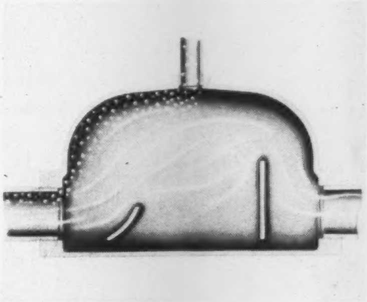
Air Conditioning Units . . .

. . .for heating and cooling schools, office buildings, and similar structures. Two models available: ceiling unit (shown) for suspended installation; hideaway model for concealed installation. Ceiling models have direct drive or belt drive motors. Nominal capacities from 2 to 10 tons. Designed for use with hot or chilled central water supply systems. *McQuay, Inc., 1600 Broadway, N.E., Minneapolis, Minn.*



Centrifugal Pumps . . .

. . .vertical split case pumps for handling high capacities at medium to high heads and continuous operations. Capacities range to 6000 gpm and heads to 380 ft. *Aurora Pump Div., The New York Air Brake Co., 619 Loucks St., Aurora, Ill.*



Air Eliminator . . .

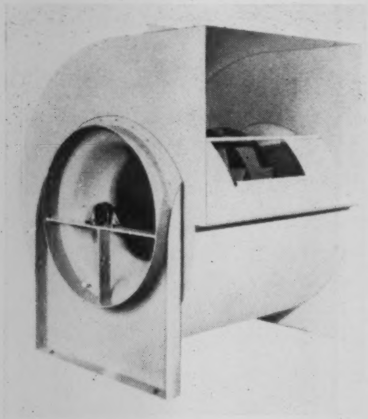
. . .for use in all hydronic systems. Made in four sizes, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$ in., one-piece cast iron unit has cast-in deflectors to direct air upward to $\frac{1}{2}$ in. vent connection where air is eliminated. Unit has no moving parts. *H. A. Thrush & Co., Peru, Ind.*

Dust Collector . . .

. . .high temperature glass cloth unit available in sizes from 1980 to 17,825 cfm in single units for intermittent or continuous operation. Siliconized glass fabric bags designed to withstand constant temperatures of 550 F available in $11\frac{1}{2}$ in. diameters with lengths of 14 to 21 ft. Bulletin No. 283 sent on request. *American Air Filter Co., Inc., Dept. PD, 215 Central Ave., Louisville 8, Ky.*

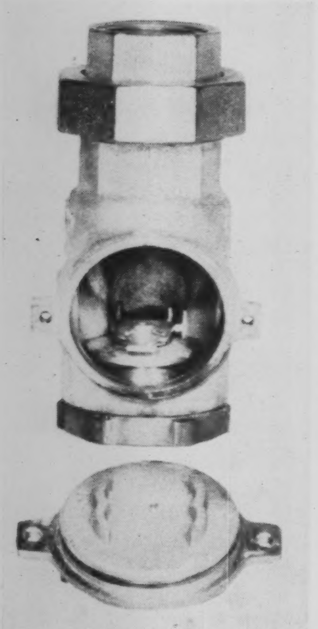
EQUIPMENT DEVELOPMENTS

Continued



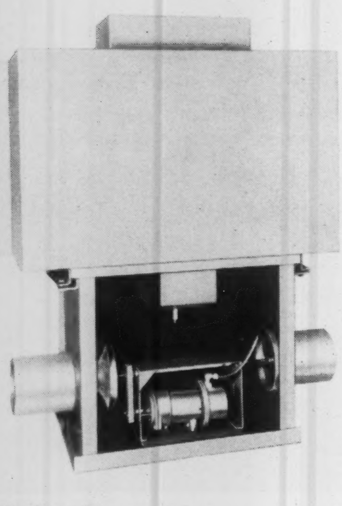
Centrifugal Fan . . .

. . . features a deepened inlet cone and all welded backward curved, spun wheel shrouds. Designed to move from 344 to 725,840 cfm of air. Accessory items include variable inlet vanes for volume control, inlet guard screens, access doors and housing drains, outlet dampers for volume, cooling wheels, vibration bases and belt guards, and weather hoods. *Sales Engineering, Bayley Blower Co., 1817 S. 66th St., Milwaukee 14, Wis.*



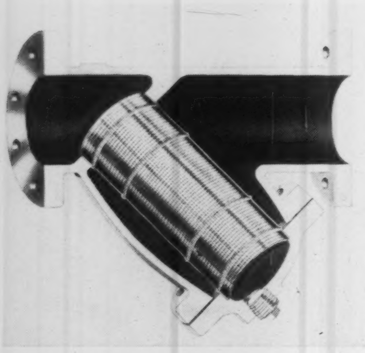
Vertical Check Valve . . .

. . . used to maintain prime in liquid lines. In operation, disc swings completely out of flow passage for minimum pressure drop; disc swings downward to a raised seat when flow stops. Bulletin "NP 16 E" sent on request. *OPW-Jordan Corp., 6013 Wiehe Rd., Cincinnati 13, O.*



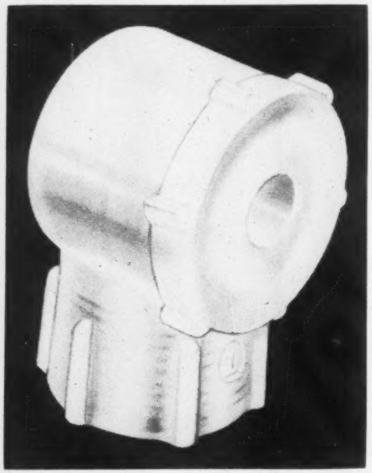
Mixing Boxes . . .

. . . with attenuation chambers and single-motor actuated mixing valves. Available in ceiling and "under the window" models. Distribution of air is from firm's diffusers. Technical catalog HV-100, containing performance data, dimensions, and illustrations, sent on request. *Air Devices Inc., 185 Madison Ave., New York, N.Y.*



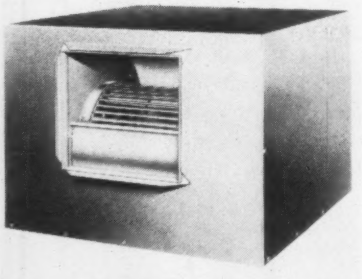
Strainers . . .

. . . for steam, water, and gas service. Choice of basket perforations for pressures up to 150 psi. Designed to provide high ratio between free area of pipe and free area of strainers to assure low pressure drop through strainers. Screwed body connections provided with removable basket; flanged body type also available. *Modine Mfg. Co., 1500 DeKoven Ave., Racine, Wis.*



Plastic Spray Nozzles . . .

. . . for use in cooling towers, evaporative condensers, spray humidifiers, air washers, and other air conditioning and industrial equipment. Absence of vanes, cores, or other obstructions in the nozzle tends to eliminate clogging. Catalog "P-1" sent on request. *Delavan Mfg. Co., West Des Moines, Ia.*



Heat Pump . . .

. . . all-electric air to air unit for commercial and other applications. Equipment is designed to be located outside, with fan-coil unit (shown) installed in attic, basement, or suspended from ceiling, or connected to duct work system. *The Trane Co., La Crosse, Wis.*

ALCO'S

New

P.O.S.

CHILLER CONTROL

THERMO® EXPANSION VALVE

Alco's New P. O. S. Valve
is engineered with the
Solenoid Pilot Stop Valve as an
integral part of the P. O. Valve.

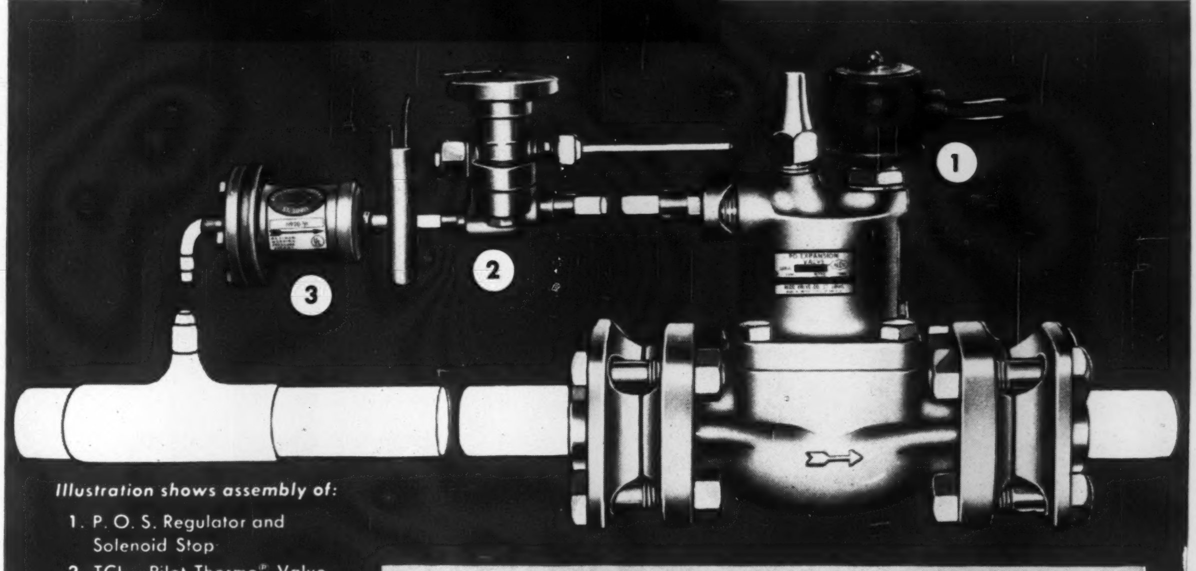


Illustration shows assembly of:

1. P. O. S. Regulator and Solenoid Stop
2. TCL—Pilot Thermo® Valve
3. H290—Line Strainer

ALCO P. O. S. VALVE ASSEMBLY—designed and engineered specifically for wide load applications—particularly recommended for refrigeration systems having capacity reduction—the ALCO SOLENOID PILOT STOP VALVE insures positive liquid "Shut-off."

ALCO PILOT OPERATED THERMO EXPANSION VALVES—give a positive control to 15% of nominal capacity with minimum superheat.

ALCO LIQUID LINE STRAINERS—insure positive protection of working parts from solder and dirt.

Capacities: 20 to 200 tons
Refrigerants 12 and 22

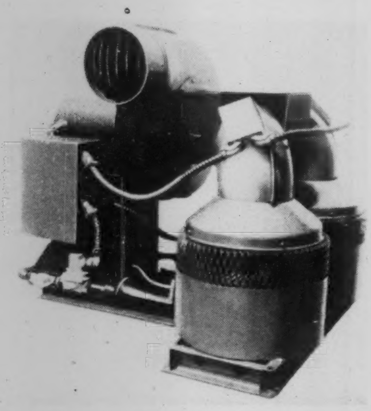
For Specifications—
Call your Alco Wholesaler, or write

- *BUY SECURITY*
- *BUY QUALITY*
- *BUY ALCO*

8220

ALCO VALVE CO.
[illegible] KINGSLAND AVE. • ST. LOUIS 30, MO.

The one complete line of refrigerant controls: Thermostatic Expansion Valves • Refrigerant Distributors • Solenoid Valves
Refrigerant Filter-Driers • Suction Line Regulators • Flooded Evaporator Controls and Reversing Valves



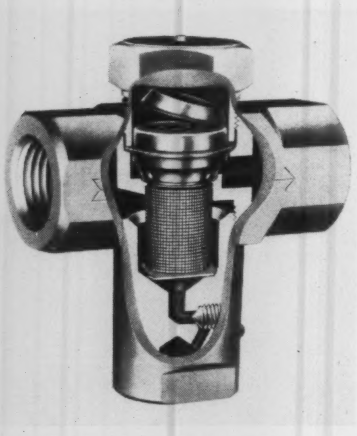
Industrial Heater . . .

. . .direct-fired gas unit has 100,000 Btu per hr capacity and is UL listed. Equipped with two sets of burners and automatic controls, served by a single blower which can be preset to discharge in 15 F increments. Blower free air delivery of 510 cfm at 2600 fpm. *Kilbury Mfg. Co., Inc., 14529 Hawthorne Blvd. Lawndale, Calif.*

HILTI - DX
RAPID FASTENING
STAMFORD Conn.

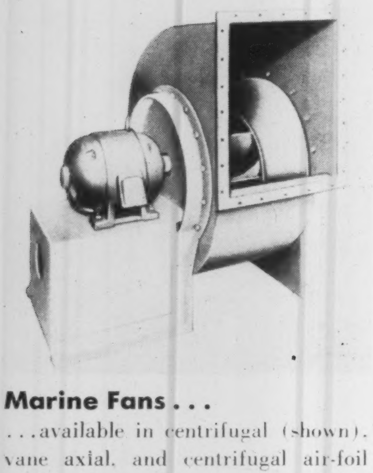
Fastening Tool . . .

. . .power unit for fastening into dense materials such as concrete, cinderblock, and structural steel. Tool starts fastener in contact with material and then pushes it in. Model "Hilti 100-L" does not require a special guard on the tool base. *Hilti, Inc., 73 Southfield Ave., Stamford, Conn.*



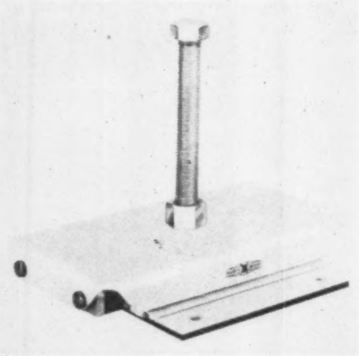
Combination Steam Trap . .

. . .for light condensate loads with steam pressures from 8 to 600 psi. Unit is an impulse steam trap with strainer and blowout valve in one body. Valve disc snaps open to discharge condensate and closes on steam. Operates against back pressures up to 50 percent of steam line pressure. Furnished with ½ in. connections. *Yarnall-Waring Co., 107 Mermaid Ave., Philadelphia 18, Pa.*



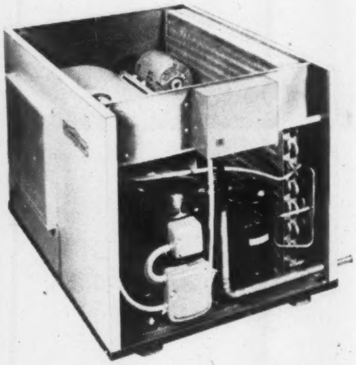
Marine Fans . . .

. . .available in centrifugal (shown), vane axial, and centrifugal air-foil models for mounting on deck, ceiling, and bulkhead. Capacities are 250 to 10,000, 1000 to 40,000, and up to 1,097,940 cfm respectively. Bulletin MF-101 sent on request. *Chicago Blower Corp., Marine Div., 9867 Pacific Ave., Franklin Park, Ill.*



Machinery Mount . . .

. . .for isolating horizontal shock and vibration. Mount will handle up to 1000 psi. static load. Neoprene controlling springs are available in various tensions, permitting selection of spring-rate suited to the forces and frequencies involved. Unit is 10 5/16 × 8 in. overall, and $1\frac{3}{8}$ in. high. *Barry Wright Corp., 700 Pleasant St., Watertown, Mass.*



Condensing Units . . .

. . .completely assembled, piped, wired, and with all safety devices installed to cut field hook-up time to a minimum. Capacity is 36,000 Btu per hr ARI standard conditions. Compressor is 3 hp. Centrifugal blower has 12 in. diameter and hermetically sealed bearings. Single or three phase wiring available. *Texas Products Mfg. Co., Waco, Tex.*

Some basic steps to
SILENT VENTILATION

ILG
ILG
ILG
ILG

The Most Important Step you can take when it comes to deciding *which* power roof ventilator is right for you is to look at an Ilg LSQ. If *capacity* is a prime factor, step up and see Ilg's 11 sizes: from 87 c.f.m. all the way up to 21,000.

If it's *silent operation,* then check these features: direct-connected fan and motor eliminate belts and pulleys; patented Type "Q" wheel is dynamically balanced before being connected to permanent-split capacitor 1-phase or 3-phase motors; totally enclosed constant- and 2-speed motors assure smooth power flow.

For a *first* step toward better ventilation, write for Bulletin No. 2302.

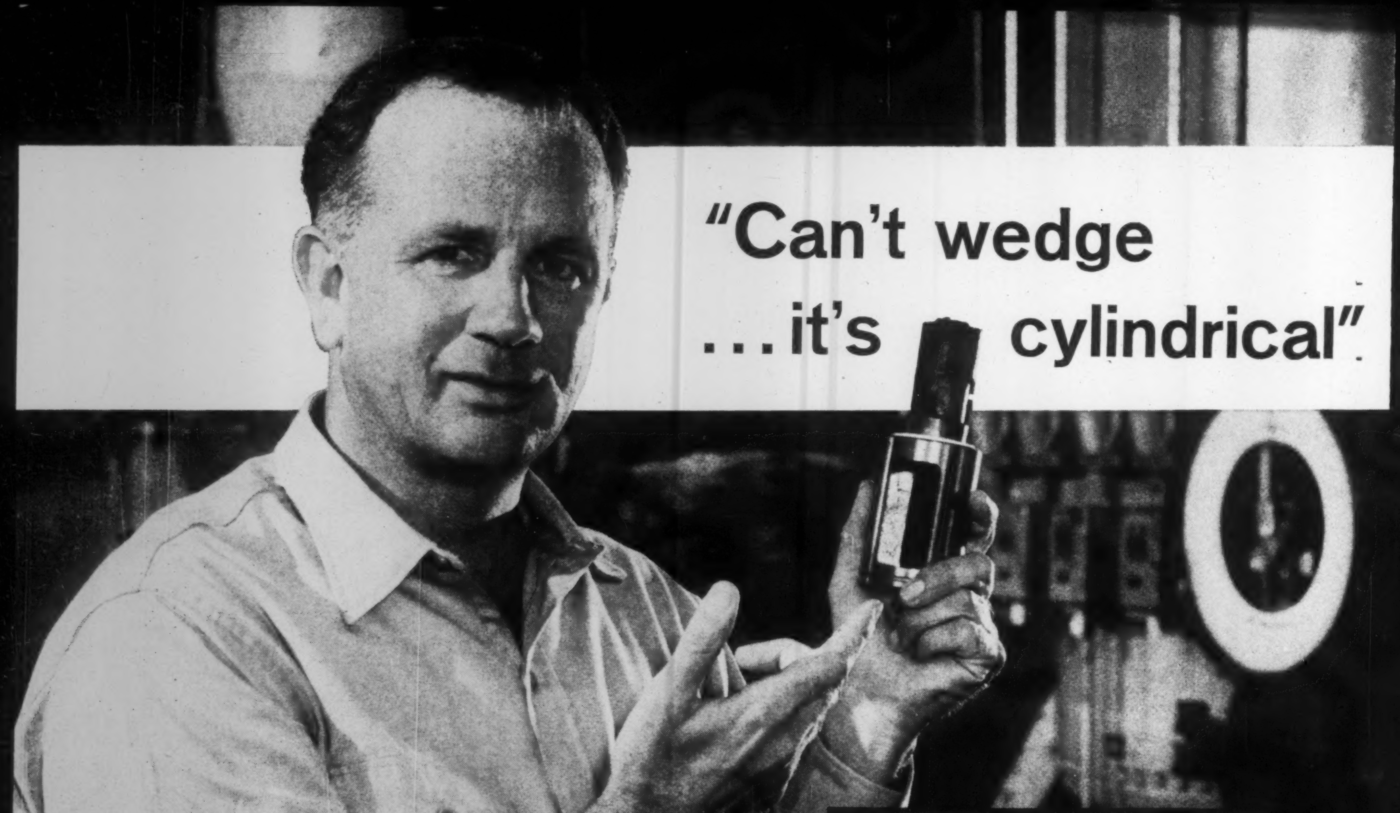
ILG

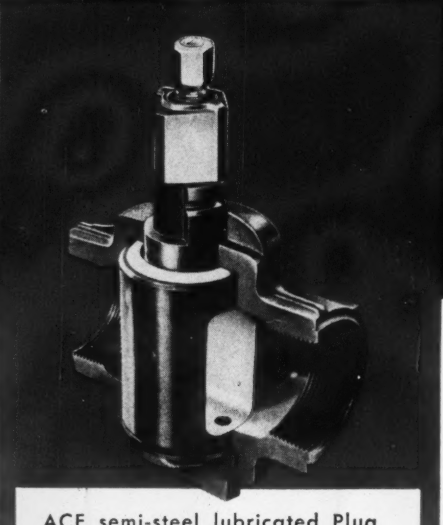
ILG ELECTRIC
VENTILATING CO.

2826 N. Pulaski Road,
Chicago 41, Ill.
Offices in
60 Principal Cities

Member of Air Moving
and Conditioning
Association, Inc. (AMCA)

"Can't wedge ...it's cylindrical"





ACF semi-steel lubricated Plug Valves are available in rectangular, round, diamond, and V ports; venturi, multiport and steam-jacketed models.

Materials: steel, semi-steel, Ni-resist, carbon steel, bronze, aluminum.

Sizes: ½" through 30".

Working Pressures: 125 through 800 pounds.

PRODUCT OF W-K-M's
Creative Engineering

acf® Lubricated Plug Valves

There's no taper to cause sticking or wedging in an ACF valve. And the plug can't be unseated.

The baseplate spring and line pressure hold the plug tight against the Teflon head seat gasket. All friction surfaces are constantly lubricated for easy quarter-turn operation and protection against corrosion.

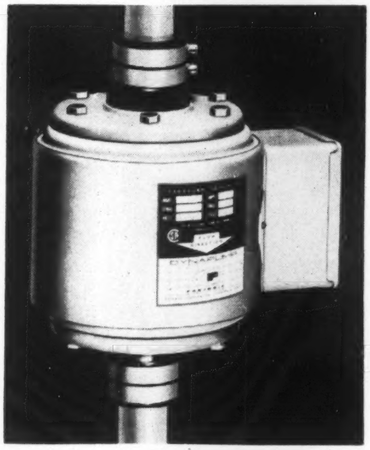
Next time — and every time — specify ACF! *Available from leading suppliers everywhere.*

WRITE FOR CATALOG 400

W-K-M

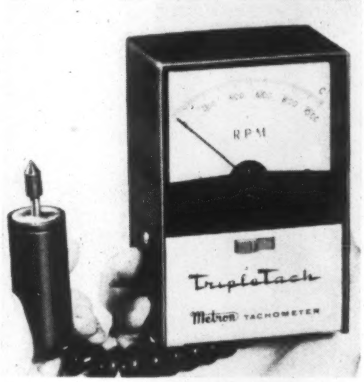
DIVISION OF acf INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

5910-R



Sealless Pump . . .

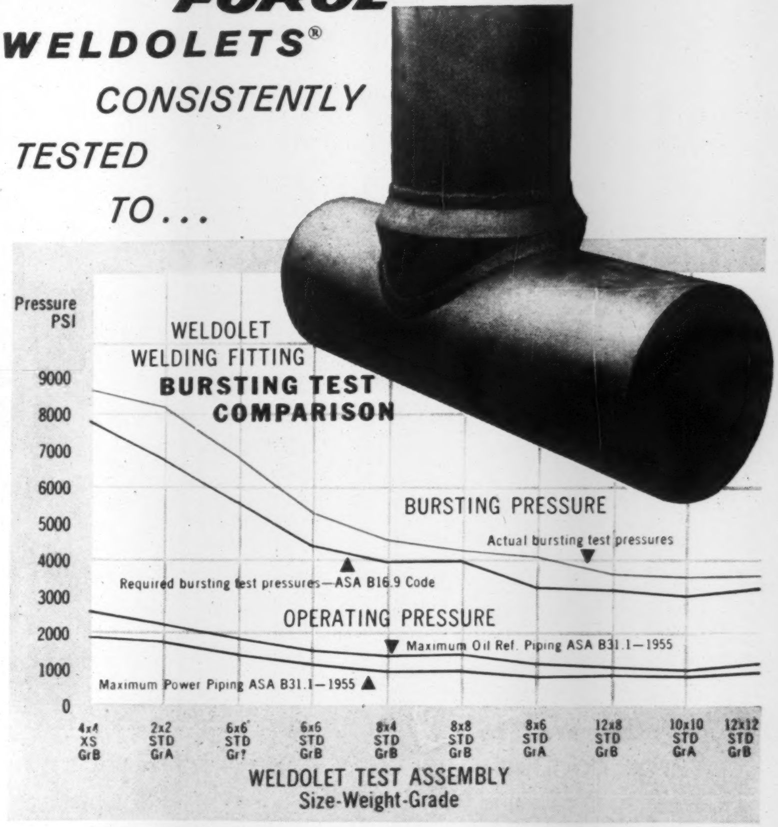
. . . for closed water circulator systems free of foreign objects and materials. Handles up to 190,000 Btu per hr in systems with 20 F temperature drop. Circulates up to 23 gpm and produces a head of 25 ft at shut-off. Suitable for pressures to 30 psi and temperatures to 220 F. Available for operation on 115 or 220 v, single phase, 50 or 60 cycles. *Fostoria Corp., 1200 N. Main St., Fostoria, O.*



Hand Tachometer . . .

. . . features small size and light weight. Unbreakable metal case contains sealed meter movement, printed circuitry, speed pick-up and its retractable cord, and storage space for shaft tips and accessories. Three sizes measure 200 to 10,000 rpm, 100 to 5000 rpm, and 20 to 1000 rpm. Accuracy is ±1 percent of full scale. *Metron Instrument Co., 432 Lincoln St., Denver 3, Colo.*

BONNEY FORGE
WELDOLETS®
CONSISTENTLY
TESTED
TO . . .



. . . OVER
4½ TIMES MAX. OPERATING PRESSURE

"Shape of Reinforcement"—has been pioneered by Bonney for the past 20 years. The fact that shape is as important and even more important than area replacement for branch reinforcement is now gaining wide industry recognition. Even though Weldolets *do* have sufficient area replacement, the factor setting them apart from conventional lap type reinforcement is their SHAPE . . . Reinforcement close to the juncture—completely bonded homogeneous reinforcement avoiding cracks, fillet welds, and re-entrant corners—reinforcement tapering at the sides to prevent abrupt change in thickness where fitting joins header pipe.

Recent design improvements in the Weldolet line, based on extensive stress analysis tests, provide all these desirable "shape" factors. Specify and use Weldolets for all your full size and reducing branch connections. They are available in carbon steel and all alloys for any piping service.

BONNEY

WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®
SWEEPOLETS®

CARBON STEEL
STAINLESS
ALLOY
for all services

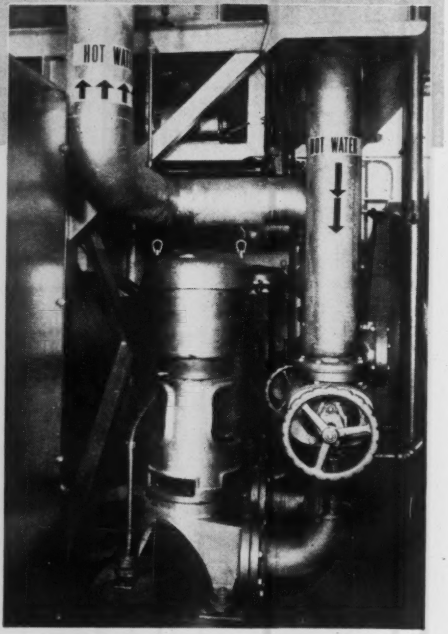
BONNEY FORGE and TOOL WORKS
ALLENTOWN, PENNSYLVANIA

SPECIFY THE weil

VKY

Space Saving

VERTICAL CIRCULATING PUMP



for

- CIRCULATING HOT WATER FOR HEATING
- CIRCULATING CHILLED WATER FOR COOLING
- CIRCULATING CONDENSER WATER
- BOOSTER PUMP SERVICE
- Capacities to 750 GPM.

QUIET OPERATING
EFFICIENT PERFORMANCE

An all ball bearing pump designed for continuous operation!

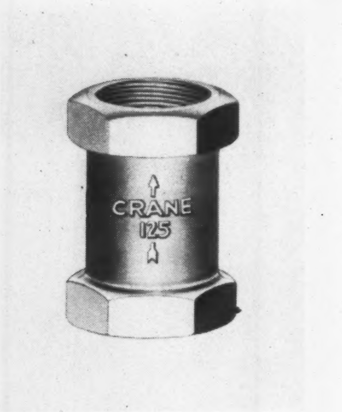
THE weil VKY pump . . .

The highly efficient VKY PUMP requires only one shaft seal. Supply and discharge piping are on one side only. All operating parts may be removed without disturbing any piping connections. Motor is a standard frame NEMA C mount with standard shaft extension. Vibration is eliminated by three rubber vibration eliminator mounts. Noise transmission is reduced to an absolute minimum.

SEND FOR BULLETIN VKY-6900.

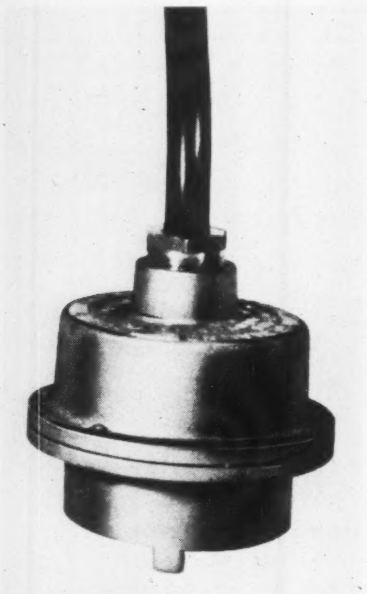
weil PUMP COMPANY

1514 N. Fremont Street, Chicago 22, Illinois



Vertical Check Valves . . .

. . . made of bronze, one piece construction, 125 lb unit incorporates use of hexagon ends; smaller, reduced ports, and a new type of guided disc for accurate seating in the 1/4 to 3/8 in. sizes; sizes range from 1/4 to 3 in. — *Crane Co., 155 N. Wacker Drive, Chicago 6, Ill.*

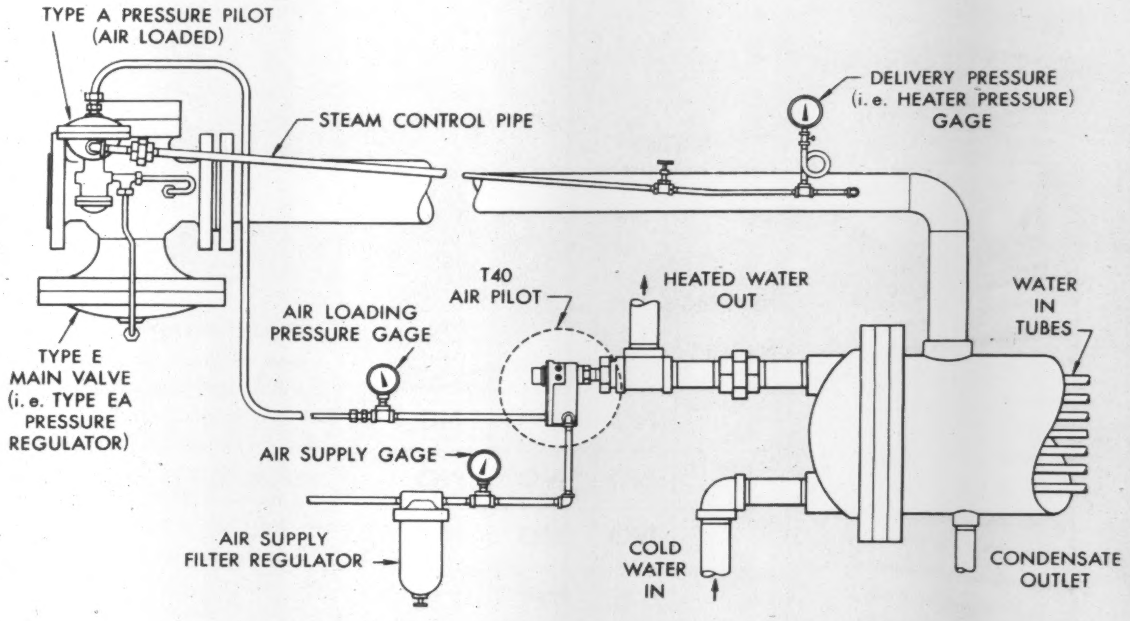


Liquid Level Control . . .

. . . to sound alarm, actuate pumps, valves, warning lights, or other electrical equipment. Available as a normally-open switch (Model 108C) or as a normally-closed switch (Model 108D). *Kenco Pump Div., 1305 Oberlin Ave., Lorain, O.*

VALVE TIPS:

New Spence Temperature Control System Gives Unusual Control Accuracy


TYPE A PRESSURE PILOT (AIR LOADED)
STEAM CONTROL PIPE
DELIVERY PRESSURE (i.e. HEATER PRESSURE) GAGE
TYPE E MAIN VALVE (i.e. TYPE EA PRESSURE REGULATOR)
AIR LOADING PRESSURE GAGE
T40 AIR PILOT
HEATED WATER OUT
WATER IN TUBES
AIR SUPPLY GAGE
AIR SUPPLY FILTER REGULATOR
COLD WATER IN
CONDENSATE OUTLET

TYPE EAT40 AIR-CONTROL TEMPERATURE REGULATOR (Patent Pending)

In a recent installation, the new Spence air-control temperature regulating system provided:

- ±5°F control accuracy under wide and instantaneous load swings of 210 to 80 gallons per minute.
- Up to 50% reduction in cost as compared to instrument systems of similar accuracy.

This unique cascade-type control with throttling range adjustment independent of maximum heater pressure was developed to meet today's demand for greater control accuracy.

Additional features of the new Spence Temperature Control System include:

- 200°F wide adjustable temperature range
- Adjustable speed of steam pressure change
- Over and under temperature protection
- Pressure limit control
- Fast response
- Very low air consumption
- Field reversible for heating or cooling

The Spence Type EAT Air Control Temperature System, when properly installed, will tame wide ranging, fast changing loads of instantaneous heaters and modern heat exchangers. The cascade principle plus the use of an extremely fast responding bi-metal temperature sensing element reduce time lags and provide control stability.

Here's how the new Spence system operates:

Quick response is based on a bi-metal temperature sensing element.

Temperature pilot continuously regulates a loading air pressure.

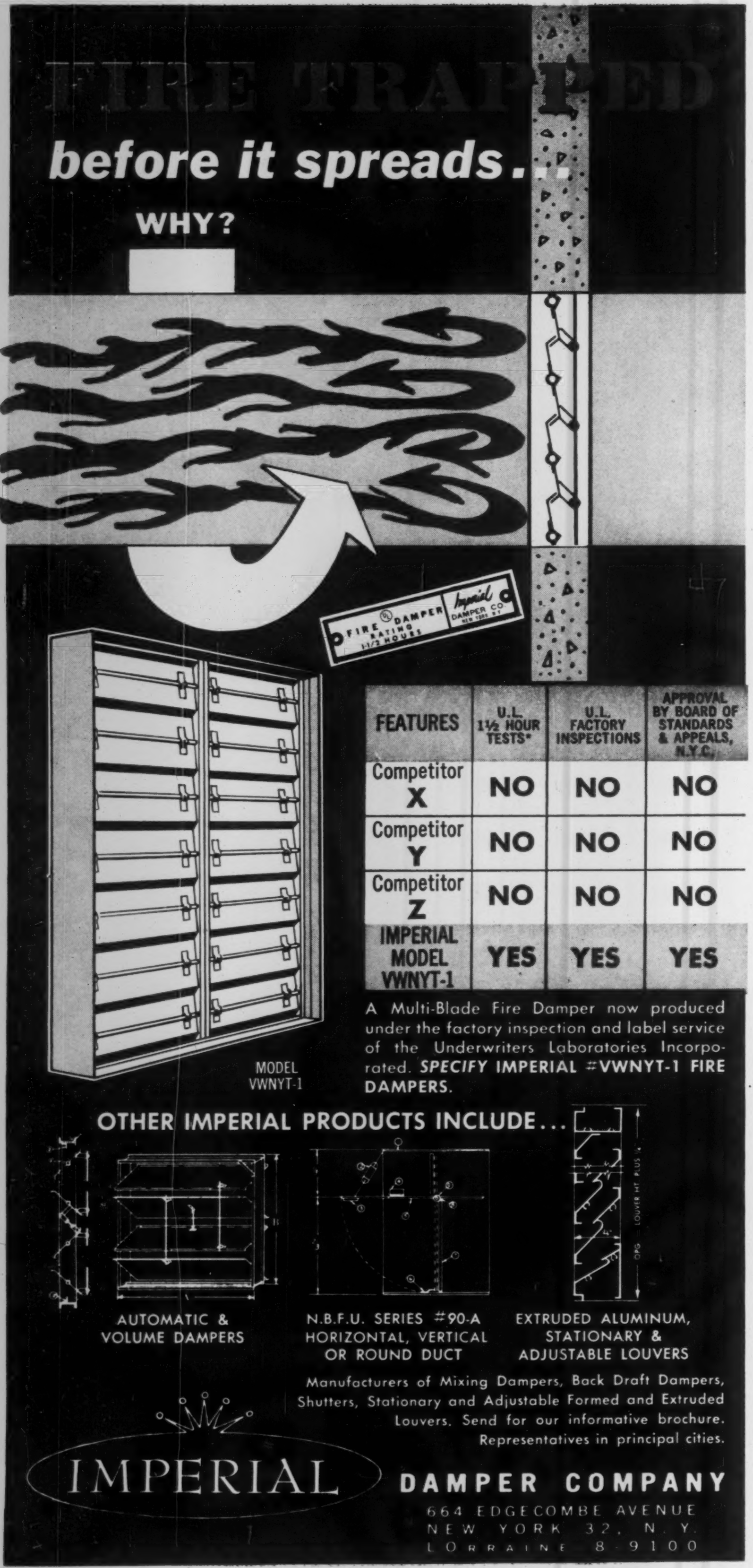
This loading signal, when applied to a pressure regulator to reflect heater temperatures, causes it to adjust the main valve as changes in load require.

Spence has also developed a new pressure control system based on this same cascade principle. This system has a control accuracy of ½ psi or better from positive pressures through the vacuum range to 30" Hg.

For complete information on these new air controlled temperature and pressure control systems, write for your copy of Bulletin 9.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

SE-148


FIRE TRAPPED
before it spreads...
WHY?
FIRE DAMPER RATING 1-1/2 HOURS
Imperial DAMPER CO. NEW YORK N.Y.
MODEL VWNYT-1

FEATURES	U.L. 1½ HOUR TESTS*	U.L. FACTORY INSPECTIONS	APPROVAL BY BOARD OF STANDARDS & APPEALS, N.Y.C.
Competitor X	NO	NO	NO
Competitor Y	NO	NO	NO
Competitor Z	NO	NO	NO
IMPERIAL MODEL VWNYT-1	YES	YES	YES

A Multi-Blade Fire Damper now produced under the factory inspection and label service of the Underwriters Laboratories Incorporated. *SPECIFY* **IMPERIAL #VWNYT-1 FIRE DAMPERS.**

OTHER IMPERIAL PRODUCTS INCLUDE...

AUTOMATIC & VOLUME DAMPERS

N.B.F.U. SERIES #90-A HORIZONTAL, VERTICAL OR ROUND DUCT

EXTRUDED ALUMINUM, STATIONARY & ADJUSTABLE LOUVERS

Manufacturers of Mixing Dampers, Back Draft Dampers, Shutters, Stationary and Adjustable Formed and Extruded Louvers. Send for our informative brochure. Representatives in principal cities.

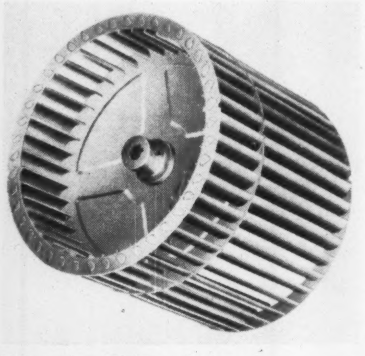
IMPERIAL **DAMPER COMPANY**
664 EDGECOMBE AVENUE
NEW YORK 32, N. Y.
LOrraine 8-9100

EQUIPMENT DEVELOPMENTS

Continued

Desuperheater . . .

. . . gives constant atomizing of cooling water regardless of steam header flow rate. Available in 300, 600, 900, and 1500 lb classes, with mounting flanges of 3, 4, 6, and 8 in. sizes. Units meet all ASA and ASME pressure codes and standards up to 1500 lb. Bulletin sent on request. *Republic Flow Meters Co., 2240 Diversey Parkway, Chicago 47, Ill.*



Blower Wheels . . .

. . . for central air conditioning systems. Line consists of both single and double inlet units. Hubs available in either ledloy steel or aluminum construction. Bulletin "2050" sent on request. *Revcor, Inc., 251 Edwards St., Carpentersville, Ill.*

WATERLOO

Airline Grilles

All Extruded Aluminum Units for Floors, Sills and Walls

Streamlined Waterloo *Airline Grilles* fit perfectly into modern architectural and engineering concepts. These extruded aluminum grilles, available up to 12 feet in length in one piece construction, are excellent for every type of floor, sill and wall application.

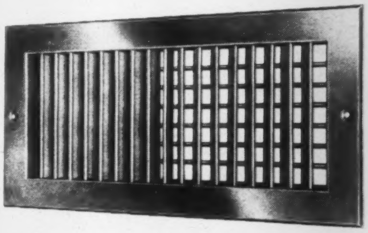
Designed to match a wide range of architectural finishes, Waterloo *Airline Grilles* feature a unique bar-support method that makes them practically tamper-proof. Since these units are designed with ¼″ face bars on ½″ centers, they are heel and pencil proof.

Write for comprehensive Selection Guide on these new multi-purpose Waterloo Grilles.

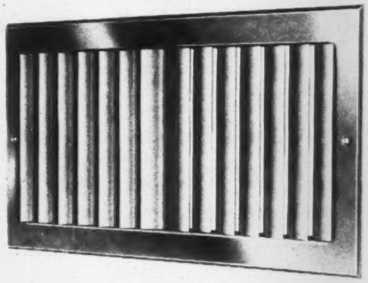
WATERLOO
Air Diffusion
EQUIPMENT

Waterloo Offers a Complete Line

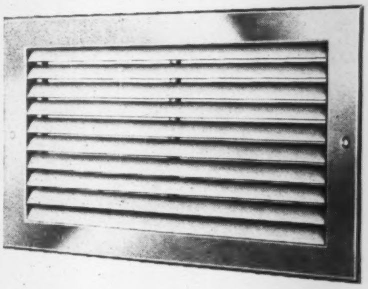
TYPICAL WATERLOO UNITS:



WATERLOO
SUPPLY
GRILLES
★
MODEL
2V



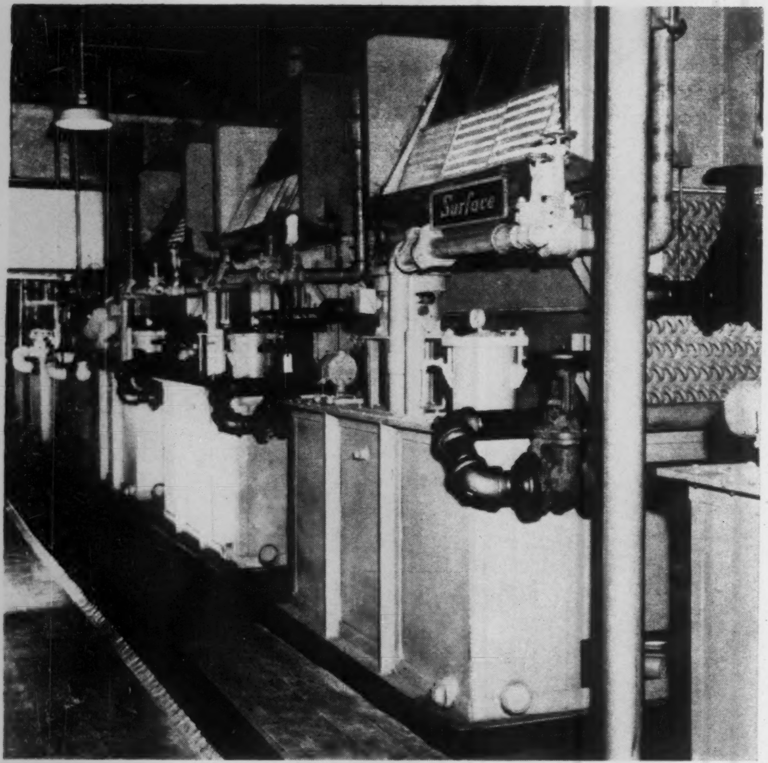
WATERLOO
CURVED
LOUVER
GRILLES
★
MODEL
1 CV2



WATERLOO
RETURN AIR
GRILLES
AND
REGISTERS
★
MODEL
3HD

WATERLOO REGISTER COMPANY, INC.
P.O. BOX 72, WATERLOO, IOWA

WR 119



120 GRAINS CUT TO 45 IN 200,000 cfm OF AIR WITH 85° TOWER WATER

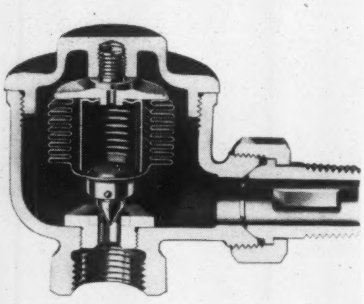
Without Kathabar, this job would have taken 1800 tons of refrigeration, at about 35F and reheating air from about 45F to 98F! With Kathabar the job took 63 hp instead of 2000. Ask the men who have seen Kathabar Type C units serve for years with practically no maintenance. Write for specific information.

SURFACE COMBUSTION
Division of Midland-Ross Corporation
2384 Dorr St., Toledo 1, Ohio
Send facts on Kathabar systems for the following application:

name and title
company
street
city *zone* *state*

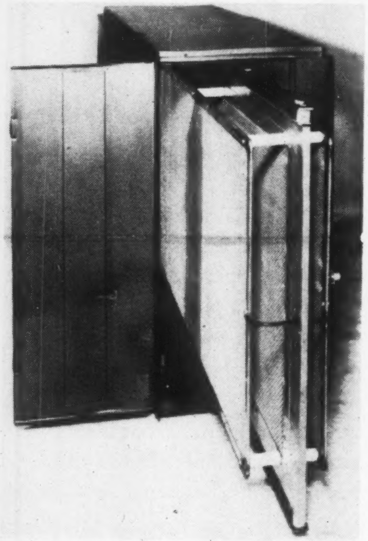
EQUIPMENT DEVELOPMENTS

Continued



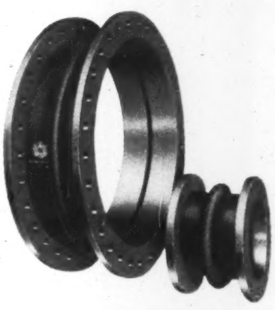
Thermostatic Traps . . .

. . . for low pressure vapor and vacuum steam heating service. Available in three standard sizes and five body models, with diaphragm or bellows type elements. For service on radiators, convectors, drip points, steam equipment, and other applications. Operating pressure from 15 to 25 psi. *Modine Mfg. Co., 1500 DeKoven Ave., Racine, Wis.*



Dust Control Screens . . .

. . . eight models of screens for firm's system of dust and dirt control, an electronic method of particulate bombardment and negative ionization of air stream particles. Constructed of heavy gage metal and galvanized wire mesh, units have all welded framing with reinforced corners. Horizontal or vertical models with capacities of 5000 and 10,000 cfm. *CRS Industries, Inc., 1405 Locust St., Philadelphia 2, Pa.*



R/M RUBBER EXPANSION JOINTS AND PIPE

Precision engineered expansion joints overcome pipe expansion stress, insulate against noise and vibration, avoid misalignment.

- MAXIMUM RESISTANCE TO SHOCK
- GREATER RECOVERY FROM MOVEMENT
- NO EMBRITTLEMENT WITH AGE
- REQUIRES NO GASKETS
- ABRASION AND CORROSION RESISTANT

CONDOR FLEXIBLE RUBBER PIPE replaces pipe lines subject to noise and vibration. Outlasts iron or steel. No leaky joints at bends. Easy installation. Write for Bulletin M685.

CONDOR V-BELTS

For heavy industrial multiple belt units.

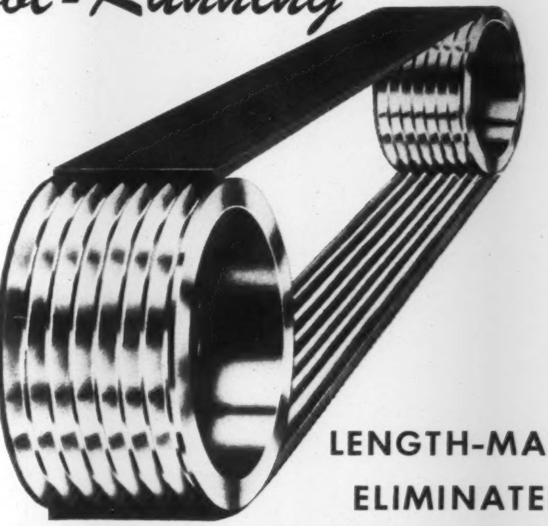
- PRECISION MADE
- SMOOTHEST RUNNING V-BELTS MADE
- MORE GRIP, LESS SLIP
- LONGER, TROUBLE-FREE SERVICE
- LOWER DRIVE COSTS

NEW R/M CX V-BELT*

- EXTREMELY QUIET . . . VIBRATION-FREE
- ONLY FULLY-MOLDED, FULLY-JACKETED NOTCHED V-BELT
- FOR SMALL PULLEYS
- FLEXIBLE, RUGGED, STRONG
- OUTLASTS OTHERS UP TO 8 TO 1
- NO FLEX-CRACKING
- HOLDS SHAPE AND EFFECTIVE LENGTH WITHOUT STRETCH

*Made for original equipment. Patented.

SMOOTH QUIET *Cool-Running*



LENGTH-MATCHING ELIMINATED WITH R/M POLY-V® DRIVE

For industrial air conditioning blowers, pumps and compressors—wherever heavy duty power equipment is required—*no* drive compares with patented R/M Poly-V! Major causes of V-drive trouble are engineered *out* of Poly-V . . . length matching problems are completely eliminated . . . drive-life is much longer . . . and just *two* Poly-V belt cross sections fulfill every heavy duty power requirement.

MORE POWER . . . LESS SPACE . . . WITH RELIABILITY

A single, endless V-ribbed belt runs smoothly over specially designed, precisely mating sheaves to deliver *equal* power in much less space than conventional V-drives—or much *more* power in the *same* space. Excessive vibration, noise, belt and sheave wear . . . all are eliminated with Poly-V. And Poly-V Belt *can't* sink into sheave grooves under loads; maintains complete contact-pressure, constant speed ratios for smoother, cooler, quieter running performance, no load to full load. Let an R/M representative show you how R/M Poly-V Drive can give you greater VIBRATIONLESS power delivery, greater drive dependability, longer life for your air conditioning or heating equipment applications. Write for Bulletin M141.

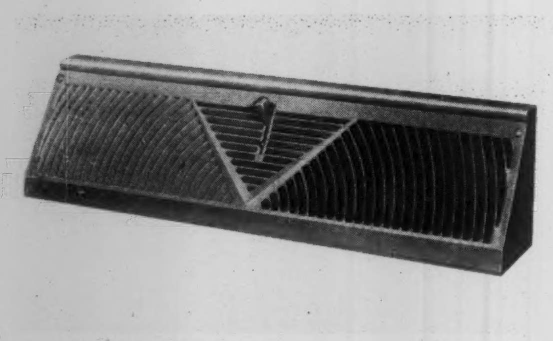
WHEN YOU CHANGE DRIVES . . .
CONVERT TO R/M POLY-V DRIVE AND BE SURE!

ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

RM

RM1008

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

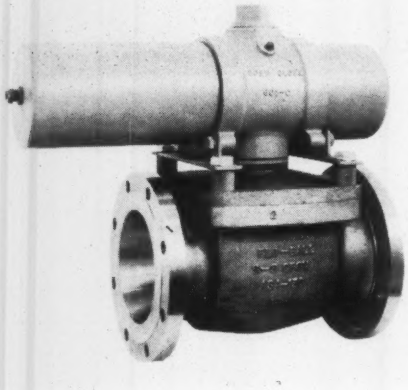


Baseboard Diffusers . . .

. . . all-steel construction 18 in. unit. Entire face is in upwardly slanted plane with 38 sq in. of free area. Curvilinear fins used in conjunction with horizontal fins. Balancing stop on face of unit. *Hart & Cooley Mfg. Co., Holland, Mich.*

Packless Valve . . .

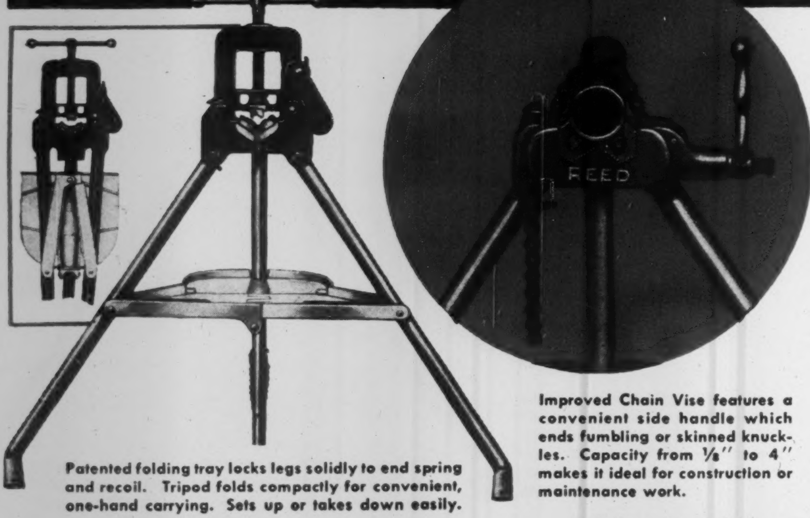
. . . for instrument air and other gas and liquid services. Resilient diaphragm withstands deformation by trapped impurities while providing tight shut-off. Rated for 500 psig and 180 F. Unit is furnished with ⅛ or ¼ in. NPT connections. *George W. Dahl Co., Inc., 86 Tupelo St., Bristol, R. I.*



Flo-Ball Valve . . .

. . . for industrial application, 8 in. unit has high capacity, top loading, spring return, zero leakage, low torque, and quarter turn actuation. Rated at 150 psi. ASA, valve is equipped with a close coupled, air-operated actuator with manual override. Can be operated normally open or normally closed. Available in carbon or stainless steel. *Hydromatics, Inc., 5 Lawrence St., Bloomfield, N. Y.*

REED PORTABLE *Folding Tray* TRIPOD VISES



Patented folding tray locks legs solidly to end spring and recoil. Tripod folds compactly for convenient, one-hand carrying. Sets up or takes down easily.

Improved Chain Vise features a convenient side handle which ends fumbling or skinned knuckles. Capacity from ⅛" to 4" makes it ideal for construction or maintenance work.

Now available with a new and better Chain Vise or the long-jaw Yoke Vise

Reed Folding Tray Tripods are well known for their work-saving solidity and the ease with which they can be carried, set up or taken down.

The Chain Vise Model is easy and convenient to use because the handle is at the side where you can turn it easily and naturally. The chain drops into position even on 4" pipe. You never have to hold it with one hand while you tighten with the other. Hardened vise jaws have three faces for triple life.

The Yoke Vise Model features the patented Reed long-bearing alloy steel jaws which provide a "wrench" action . . . so that a slight handle pressure holds any pipe from ⅛" to 2½". Reversible lower jaws. Special features to end lost motion.

Ask your jobber or write for free literature.

REED TRADEMARK MANUFACTURING COMPANY
ERIE, PENNSYLVANIA • U. S. A.

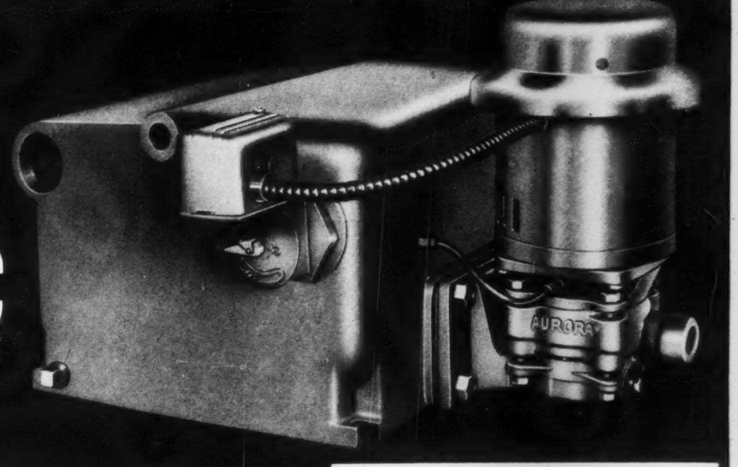
FOR ECONOMY... EFFICIENCY... AND PERFORMANCE... SPECIFY

AURORA®

Packaged

COND-A-PAC

CONDENSATION RETURN UNITS



Capacities to 15000 EDR–To 23 GPM

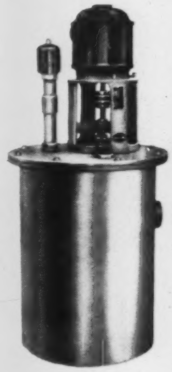
- Low NPSH . . . smooth ultra-quiet operation . . . impeller design with curved inlet blade tips that minimize shock loss as the liquid enters the impeller.
- Stainless steel shaft—rigid design eliminates shaft deflection and assures longer life for seal or packing.
- Stainless steel seals . . . maximum corrosion resistance . . . longer trouble-free life.
- High efficiency . . . low horsepower requirement . . . less power is needed to provide required delivery . . . less initial cost and lower operating expense.
- Utmost compactness — minimum floor space requirements.
- Low return — permits maximum flexibility of application.
- Rugged pump and receiver construction provides maximum long term top performance.
- Complete unit . . . ready for installation of lead lines.
- Self venting . . . will not vapor lock.
- Combination float switch and alternator optional when desired.
- Simplex or Duplex units.

Aurora Pump specialists are always available for consultation on your requirements

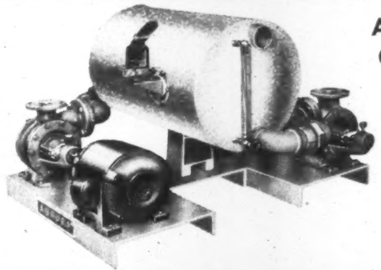
FOR GREATER CAPACITIES . . . OR SPECIAL CONDITIONS

VERTICAL UNITS

Capacities to
100,000 EDR
150 GPM



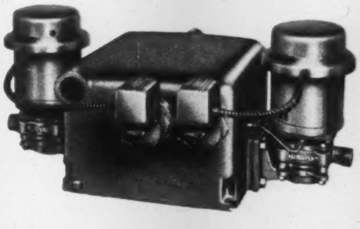
Ideal for applications where return is extremely low or below floor level.



APCO HORIZONTAL UNITS
**Capacities to 100,000 EDR
150 GPM**

With automatic range adjustment, equalized pressure, and the many advantageous features of APCO Turbine Type Pumps

TYPE C HEAVY DUTY UNITS
**Capacities to 150,000 EDR
225 GPM**

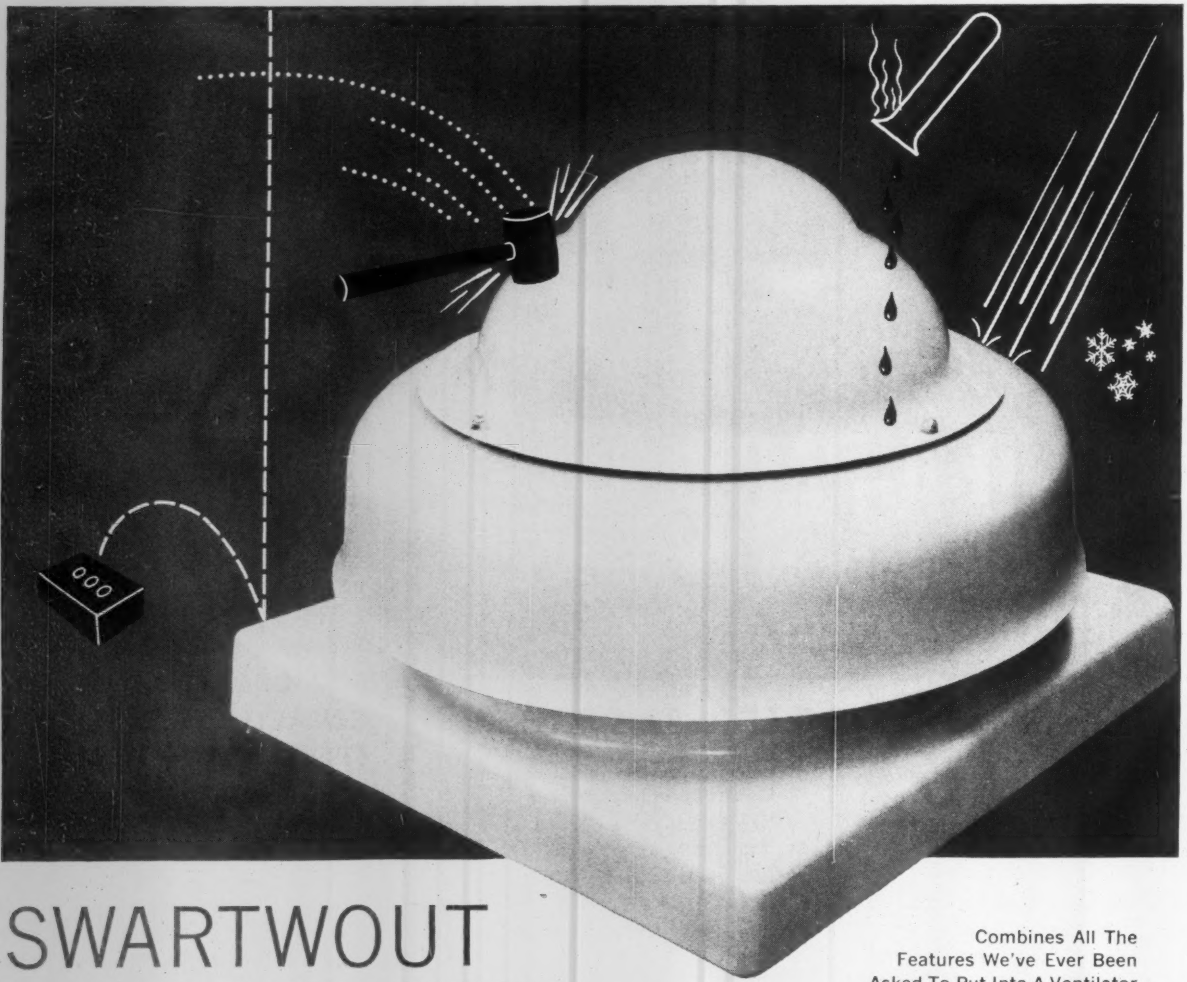


For high capacity or heavy duty applications. Packing Boxes on pumps optional when desired.

AURORA *Always* PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
650 LOUCKS • AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK



SWARTWOUT FIBER-AIRE

Combines All The
Features We've Ever Been
Asked To Put Into A Ventilator
. . . At No Premium In Cost!

With Fiberglas* Housing . . . Stainless Steel Wheel

Quiet enough for the president's office yet rugged enough for the toughest plant conditions.

Indestructible — tough, resilient Fiberglas housing is virtually impossible to dent, crack or break . . . impervious to most chemicals, weather, salt spray.

Low initial cost — in spite of its many exclusive features and highest quality materials and construction, Fiber-Aire costs less than many other ventilators with fewer advantages.

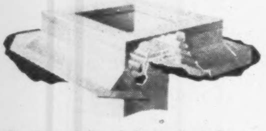
Low operating cost — new design stainless steel air flow guides plus low turbulence throat and outlet give 20% to 50% greater efficiency than most radial discharge centrifugal ventilators.

Low maintenance cost — molded-in color never needs painting . . . Fiberglas insulates motor to run cooler, longer . . . housing can't rust or corrode.

Super-quiet — low turbulence design cuts noise generation . . . all Fiberglas housing actually absorbs noise and vibration.

"Invisible" color — molded-in SX-100 sky-blue color makes Fiber-Aire almost impossible to see against the sky . . . actually becomes more blue on bright days and grayer on dull days. Leaves roof lines clean and attractive.

Available in Direct Drive and Belt Drive Centrifugal and Direct Drive Axial Models . . . 180 to 13,150 C.F.M.



Optional Prefabricated Curb

Swartwout "Insta-Curb" speeds installation . . . assures correct mounting . . . provides long-lasting, low-cost, custom-made curb for Fiber-Aire units.

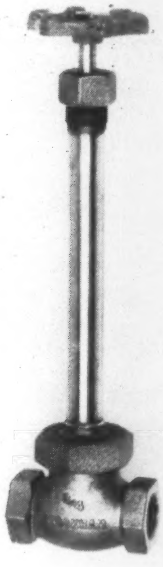
"Fiber-Aire"
Swartwout

Free engineering service plus complete information on Swartwout's full line of power and gravity ventilators available on request. Write or call today.

* TM — Owens Corning Fiberglas Corporation

Swartwout

SWARTWOUT
Fabricators, Inc.
Kokomo, Indiana
In Canada: Eastern Steel Products, Ltd., 8 Bermondsey Rd., Toronto, Ont.



Valves . . .

. . . for liquid oxygen, nitrogen, and hydrogen service. Bronze gate, globe, and angle valves have extended bonnets and "teflon" impregnated braided asbestos packing. Solid "teflon" packing also available. Units are thoroughly degreased and sealed to prevent contamination. *Stockham Valves and Fittings, Box 2592, Birmingham 2, Ala.*

HARRIS CALO
CO

Gas Regulator . . .

. . . for oxygen, carbon dioxide, helium, nitrogen, argon, hydrogen, propane, and acetylene. Can be mounted in any position without affecting accuracy of flow. Gage dial is designed to show actual flow in cu ft per hr consumed. *Harris Calorific Co., 5501 Cass Ave., Cleveland, O.*

Satisfy more "tough clients" with Reznor

REZNOR direct-fired DUCT FURNACES CUT CENTRAL HEATING COSTS

You avoid the expense of boilers, piping and controls when you use Reznor direct-fired duct furnaces.

These features cut installation time and costs:

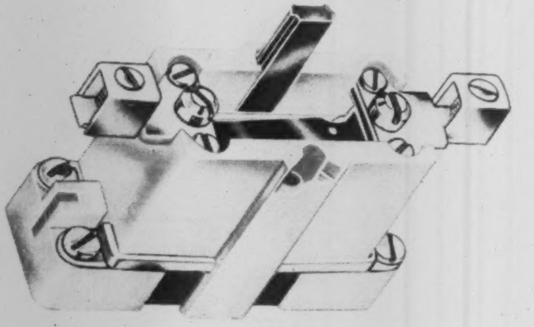
- mounting pipes at all four corners permit easy suspension or base mounting;
- double-lip flange simplifies air-tight connections;
- air can flow through heat exchanger in either direction;
- controls can face each other when heaters are in tandem;
- built-in draft diverter is reversible;
- flue collar is interchangeable for horizontal or vertical installations.

These features insure long-run economy, easy maintenance:

- Reznor furnaces have long-lasting, corrosion-resistant aluminized or stainless steel heat exchangers and non-clogging steel burners, easily accessible from front or rear;
- every furnace is flame-tested and shipped complete with U/L approved controls.

Whatever system you're planning—central heating, year-round air conditioning, make-up air, process air—Reznor fills any requirement. Heaters may be used singly in capacities up to 300,000 Btuh, or in tandem or side-by-side arrangement for greater heating requirements. Reznor blowers available. Ask your Reznor representative for Catalog SA-5900. Or write Dept. 51-S, Reznor Manufacturing Co., Mercer, Pa.

REZNOR HEATERS
"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"

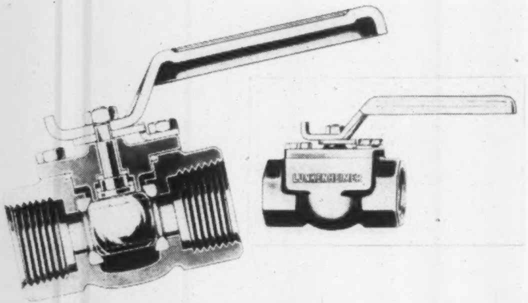


Overload Relay . . .

. . .automatically compensates for both heat and cold, operating on same time curve at all temperatures from −20 F to 165 F. Has working bi-metal and compensating bi-metal, joined by coupling bar. Calibrating screw is set and sealed, and needs no adjustment. Ratings from 25 to 300 amp, continuous current. *Arrow-Hart & Hegeman Electric Co., 103 Hawthorne St., Hartford 6, Conn.*

Gas Regulators . . .

. . .for both oxygen and acetylene cylinder use in welding, heating, or cutting operations. Two-stage units without conventional glass covered gages are particularly suited where rough usage is encountered. Oxygen regulator with maximum work pressure of 100 psi; two acetylene units with 15 psi maximum. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 150 E. 42nd St., New York 17, N. Y.*



Ball Valves . . .

. . .top entry units have self-aligning ball that rides on its seats, sealing at high or low pressure. Features bronze body, screw ends, pipe sizes $1/4$ to 2 in. Designated "Fig. 700," line is expected to be available in stainless steel and carbon steel in the future. *Lunkenheimer Co., P.O. Box 360, Annex Station, Cincinnati 14, O.*

HOW TO TAME A FLAME

Fire can be controlled exactly to assure superior performance

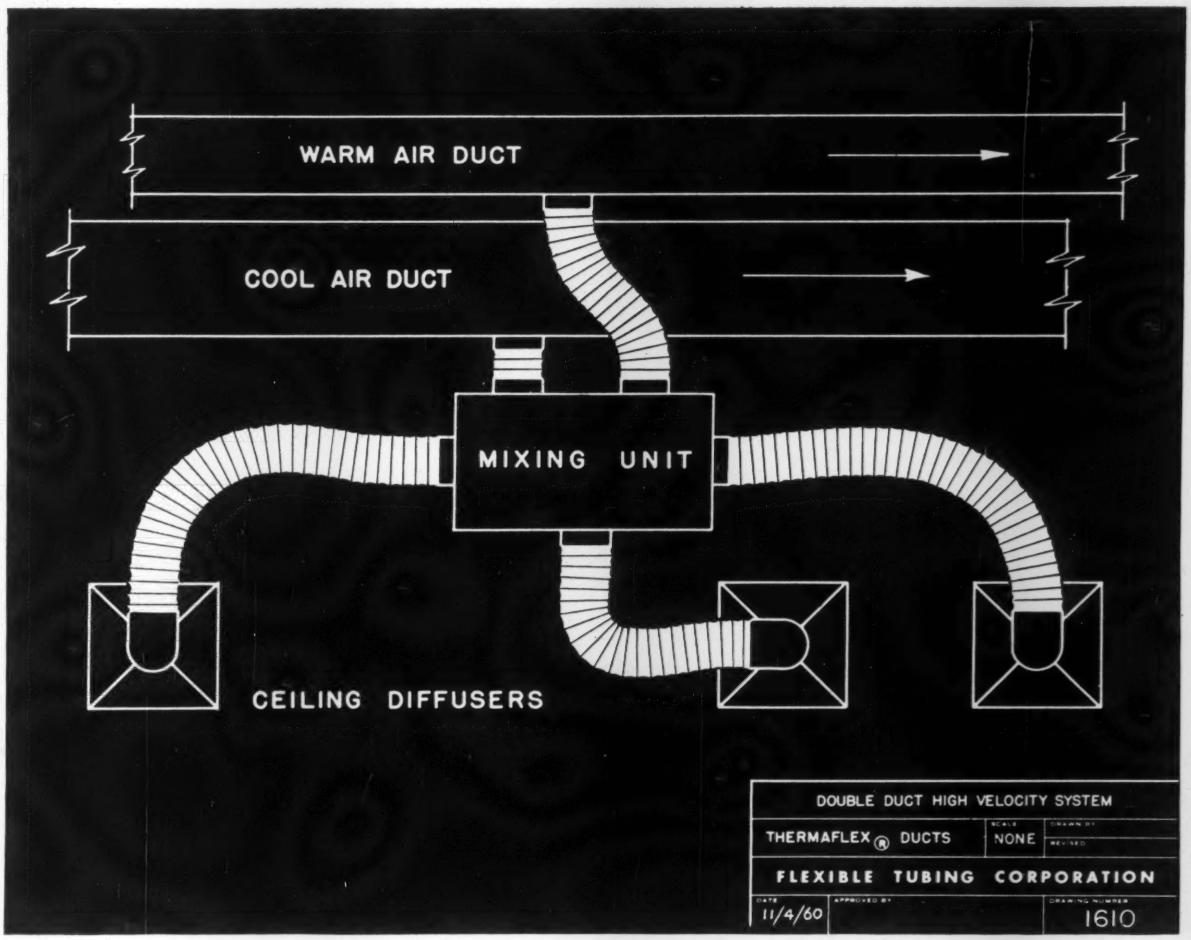
Hev-E-Duty power gas burners make a flame behave — exactly as wanted for smooth starting and top efficiency. Automatic electric spark ignition, then low-fire start with smooth, easy modulation to high-fire gives reliable performance at minimum and maximum fuel rates. Once burner is set for optimum efficiency, this setting is maintained *automatically*.

Complete package! Fully approved! Factory guaranteed! Fire tested! Simple installation! Sizes from 720,000 to 21,000,000 Btu. Also combination gas/oil models. Hev-E-Oil burners — models from 5 to 150 gph. Write Dept. HPA-110 for full flame facts.

HEV-E-DUTY POWER GAS BURNER

INDUSTRIAL COMBUSTION
INC.
EXECUTIVE OFFICE: 4507 N. OAKLAND AVE.
MILWAUKEE 11, WISCONSIN

7-60R


WARM AIR DUCT
COOL AIR DUCT
MIXING UNIT
CEILING DIFFUSERS
DOUBLE DUCT HIGH VELOCITY SYSTEM
THERMAFLEX® DUCTS
SCALE
NONE
DRAWN BY
REVISED
FLEXIBLE TUBING CORPORATION
DATE
11/4/60
APPROVED BY
DRAWING NUMBER
1610

In the double-duct high velocity system...

Flexible Tubing simplifies connections to mixing units, diffusers... gives you greater design flexibility

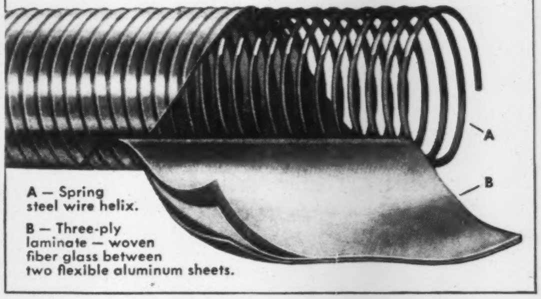
Flexible Tubing is the fast, easy way to connect supply ducts to both mixing units and diffusers. It's particularly helpful in systems that require multiple run-outs.

This highly flexible duct is constructed of a rugged cover permanently bonded to a rustproof spring wire helix. It's ideal for installations where changing space requirements will mean periodic relocation of partitions. Flexible Tubing permits diffusers to be moved *without being disconnected* — the ductwork simply trails behind!

Flexible Tubing goes around obstructions and through tight passages in gradual bends with minimum air friction. It greatly reduces noises and vibration . . . corrects for misalignment at points of take-off. Lightweight, flameproof, easy to install.

Specify Thermaflex® for the next system *you* design. For complete product data on Underwriters'-approved Thermaflex, write Flexible Tubing Corporation, 511 New Whitfield Street, Guilford, Connecticut.

See why Thermaflex-A is so flexible and long-wearing!


A
B
A — Spring steel wire helix.
B — Three-ply laminate — woven fiber glass between two flexible aluminum sheets.

Flexible Tubing
CORPORATION
Anaheim (Los Angeles) • Guilford, Connecticut
Hillside (Chicago)

New pressure controls . . . 0.5 to 150 psig.

Diaphragm Pressure Regulators

. . . with PLUS-PERFORMANCE FEATURES

Now . . . Robertshaw engineers answer still more of your pressure control problems with these highly efficient diaphragm-actuated companions to our famous *bellows* self-ops!

Ruggedly built and modestly priced, this new 1065 Series is offered in four diaphragm sizes, with nine different ranges from 0.5 to 150 psig. Single-seated ½″ to 2″ valves for positive shut-off . . . piston-balanced in the larger sizes; double-seated, 2½″ to 4″ sizes.

- **Nylon-reinforced, moulded Buna-N diaphragm**
- **Spring-loaded Teflon chevron lifetime packing**
- **Ball-bearing wheel adjustment**
- **Quick-disconnect, polished monel valve stem**
- **Stainless steel trim standard**
- **Highest quality chrome steel adjusting spring**
- **Valve designs backed by years of field service**

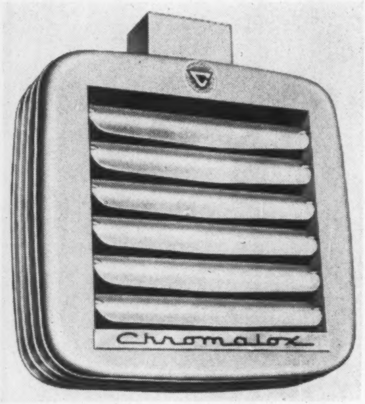
For complete specifications, ask for Bulletin VH-125. **Fulton Sylphon Division, Robertshaw-Fulton Controls Company, Knoxville 1, Tennessee.**

Robertshaw

MR. CONTROLS

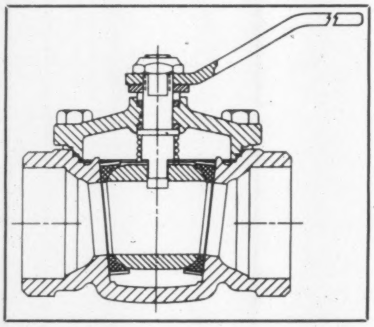
EQUIPMENT DEVELOPMENTS

Continued



Electric Unit Heaters . . .

. . . for factories, public buildings, and similar structures. Fintube electric elements with built-in line voltage protection. Enclosed fan motor, also with overload protection. Units are ceiling mounted, with swivel-type wall mounting brackets optional. Heating capacities from 17,065 to 85,325 Btu per hr. Power capacities range from 5 to 25 kw and 208 to 480 v. Bulletin "F14100" sent on request. *Edwin L. Wiegand Co.*, 7500 *Thomas Blvd., Pittsburgh* 8, *Pa.*



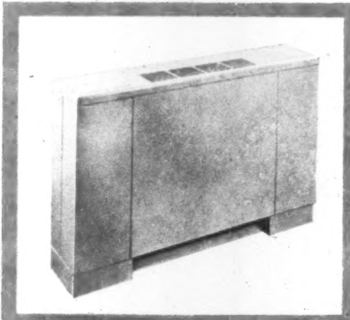
Ball Valves . . .

. . . top entry units for controlling gases, liquids, slurries, semisolids, and corrosive chemicals at temperatures from −100 F to 350 F, and pressure maximum of 700 psig, depending on temperature. Available with socket weld connections in 1, 1½, 2, and 3 in. sizes. Body materials are carbon or stainless steel. *Hills-McCanna Co.*, 4600 *W. Touhy Ave., Chicago, Ill.*

C'EST SI BON...

BOHN-AIRE

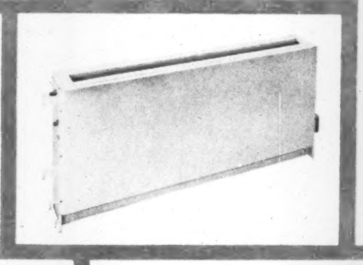
means COMFORT
in any language...
in any season!



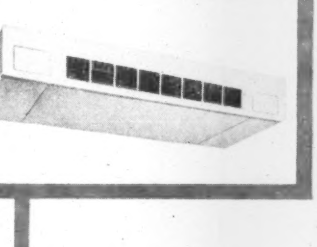
MODEL B-D for vertical floor mounting "in-the-space" or semi-recessed up to 3½".

COMPLETE FLEXIBILITY... 4 ROOM CONDITIONERS IN 5 SIZES EACH

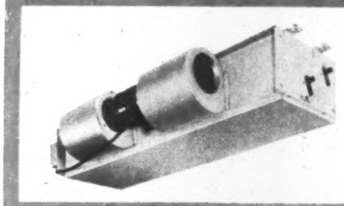
Quietly, dependably, BOHN-AIRE Remote Individual Room Conditioners provide year 'round comfort in apartments, motels, hotels, offices, hospitals... in any building with a central hydronic heating and cooling system. They are extremely compact with a slim 8½" width... available in concealed models or in attractive, durable cabinet styles... easy to install and service. Finger-tip push button control! Many optional accessories.



MODEL B-V for vertical concealed floor mounting.



MODEL B-C with finished cabinet for "in-the-space" horizontal mounting.



MODEL B-H for horizontal mounting in concealed locations (plenum optional).

BOHN

Buy the known line... the BOHN line
ALUMINUM & BRASS CORPORATION
Danville Division • Danville, Illinois

The Great Atlantic & Pacific Tea Co. • Jos. Schlitz Brewing Co. • St. Luke's Hospital • Tropicana, Inc. • Armour & Co. • Neil House • The Fish Meal Co. Standard Brands, Incorporated • Coca-Cola Co. • The Borden Co. • Swift & Co. Sperry Candy Co. • Union League Club • Miller Brewing Co. • Carnation Company • The Kroger Co. • Minute Maid Corp. • The Seven-Up Bottling Co. Wilson & Co., Inc. • Sealtest Foods • Anheuser-Busch, Inc. • Foremost Dairies, Inc. Rath Packing Co. • Pepsi-Cola Co. • Marine Bank • Falstaff Brewing Corp. Pet Milk Co. • Norbest Turkey Growers Assn., Inc. • Merchants Refrigerating Co.

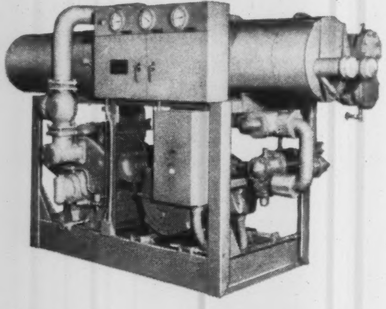
"IT HAD TO BE YOU"

...Vilter®

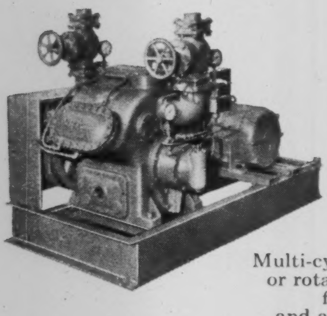
"IT HAD TO BE YOU" ... VILTER is an often said and a well founded chorus among many leading American companies when it comes to selecting quality refrigeration and air conditioning equipment. (A few of the thousands of valued Vilter customers are shown above.) They all consistently look to Vilter for sound refrigeration and air conditioning recommendations and for reliable, efficient-performing, economical-to-operate equipment.

Vilter equipment finds wide application in all industries where refrigeration and air conditioning are used—from industrial installations in meat packing and poultry plants, dairies, breweries, refrigerated fishing vessels, frozen food plants—to air conditioning systems in important hotels, motels, office buildings and hospitals.

With a complete line of industrial and commercial refrigeration and air conditioning equipment, Vilter can provide a system to exactly fit your needs.



Packaged water chillers for air conditioning.



Multi-cylinder, vertical or rotary compressors for refrigeration and air conditioning.

Vilter®
refrigeration
air conditioning

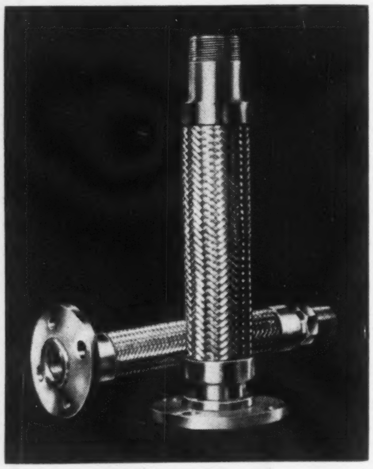
The Vilter Manufacturing Company
Milwaukee 7, Wisconsin

Air Units • Ammonia and Freon Compressors • Booster Compressors Baudelot Coolers • Water and Brine Coolers • Blast Freezers Evaporative and Shell and Tube Condensers • Pipe Coils Valves and Fittings • Pakice and Polarflake Ice machines.

Write for your copies of bulletins covering the above equipment to The Vilter Manufacturing Company, Dept. F-606 2217 South First Street Milwaukee 7, Wisconsin

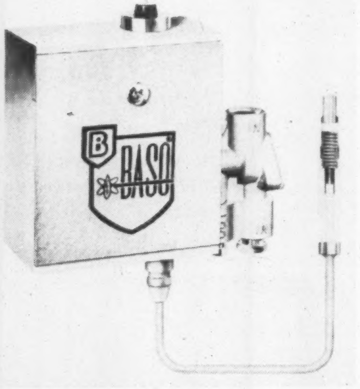
EQUIPMENT DEVELOPMENTS

Continued



Flexible Connectors . . .

. . . for absorbing or reducing the effects of pipeline vibration, misalignment, or thermal expansion in pump installations. Consists of corrugated flexible metal tubing, protected against pressure elongation by wire braid. Handles pressures to 1500 psig and temperatures to 1200 F, depending on connectors' alloy, braid construction, and size. *Allied Metal Hose Co., 3746 Ninth St., Long Island City 1, N.Y.*



Pilot Switches . . .

. . . for model gas control applications. Powered by high-voltage, semimetal thermocouple. Models "W853" and "W850" break circuit to the main electric valve if pilot light is extinguished; model "W853" also shuts off the pilot gas as well in such a situation. *Baso Inc., 730 N. Jackson St., Milwaukee 1, Wis.*

The BURGESS-MANNING 3-WAY FUNCTIONAL CEILING

—*Here's* GREATEST DESIGN FLEXIBILITY

for SCHOOL HEATING . . . COOLING . . . ACOUSTICAL CONTROL

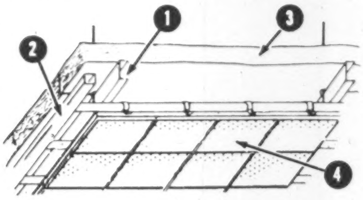
These are the 6 Points of Superiority

1. Maximum Comfort
2. Operating Economy
3. Maintenance Economy
4. Acoustical Efficiency
5. Attractive Appearance
6. Structural Simplicity

New 680 pupil Junior-Senior High School, Attica, N. Y. where Burgess-Manning Radiant Acoustical Ceiling insures a uniform temperature throughout the room, even close to windows.

Burgess-Manning perforated aluminum ceiling panels are clipped directly to coil for efficient heat transfer.

The Simple Construction of the Burgess-Manning Radiant Acoustical Ceiling



1. Suspension Grid
2. Hot or chilled water circulation coil.
3. Sound absorbing blanket.
4. Perforated aluminum ceiling panels clipped directly to coil for efficient heat transfer.

—as Proved at the Attica, N. Y. Junior-Senior High School

Concerned with school heating, cooling and acoustical control? Now . . . with the Burgess-Manning Radiant Acoustical Ceiling you combine *in one unit* all three functions to give pupil and teacher superior comfort.

The Attica, N. Y. school board members, interested in preservation of pupil health—after investigation of all types of school heating—selected the Burgess-Manning Radiant Acoustical Ceiling for their new Junior-Senior High School.

This highly effective Burgess-Manning Radiant Heating, Cooling and Acoustical Ceiling installation provides a very high standard of student and teacher comfort . . . attained at a moderate first cost, and definite economical operating costs—both well within the New York State averages for school buildings.

Simply . . . the Burgess-Manning Radiant Acoustical Ceiling provides:

1. completely uniform heat distribution with essentially no temperature variation from floor to ceiling;
2. elimination of radiators, baseboard convectors, registers, etc., permitting maximum usable floor space;
3. operation with standard hot water heating or water chilling equipment, and use of standard controls; and
4. design flexibility for layout, ventilation and lighting.

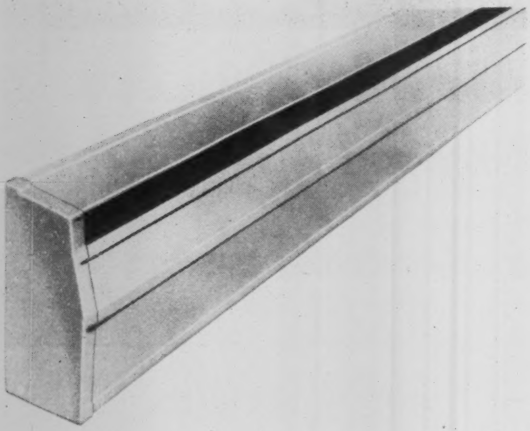
Easy to layout . . . easy to install . . . the Burgess-Manning Radiant Acoustical Ceiling gives you maximum freedom in architectural design, requires minimum building space, lower initial accommodation costs, and minimum mechanical maintenance.

Investigate the Burgess-Manning Radiant Acoustical Ceiling for school radiant heating, cooling and acoustical control! Complete descriptive literature, specifications and other pertinent design data sent on request. Today . . . write for Burgess-Manning Catalog No. 138-3G

BURGESS-MANNING COMPANY
Architectural Products Division
749 East Park Ave., Libertyville, Illinois

EQUIPMENT DEVELOPMENTS

Continued

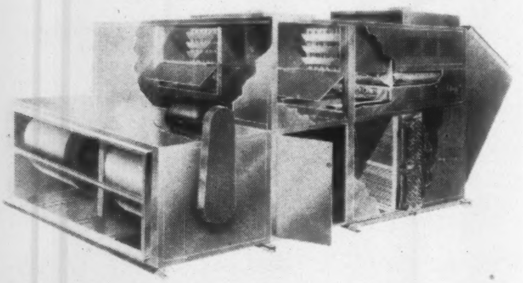


Radiant Baseboard . . .

. . . completely enclosed elements, with no grills. Air openings at floor line and top of unit. Copper tubing and aluminum fin heating element. Two standard sizes available: type "ME-7," 9½ in. high, 2⅞ in. deep; and type "ME-8," 11¾ in. high, 3 3/16 in. deep. Bulletin 360 sent on request. *Modine Mfg. Co., 1500 DeKoven Ave., Racine, Wis.*

Liquid Biocide . . .

. . . to remove bacteria and algae from industrial cooling water. Does not create dust or fumes. High flash point minimizes fire hazards. Soluble in all types of water, non-corrosive, and compatible with sulfates, phosphates, chlorides, or carbonates. *Dearborn Chemical Co., Merchandise Mart Plaza, Chicago 54, Ill.*



Air Conditioning Unit . . .

. . . for zone control applications. Packaged unit includes: horizontal and vertical arrangements; chilled water or direct expansion cooling coils from 8 to 125 tons; mixing dampers divided into number and size of zones required for job; 12 sizes from 2500 to 34,800 cfm capacity; gas-fired duct furnaces, AGA, from 200 to 1200 MBtu per hr input. *Airfan Engineering Co., 7401 Telegraph Rd., Los Angeles 22, Calif.*

STAINLESS

pipe and fittings

Your complete stainless piping package is available for immediate shipment in a variety of sizes and analyses. **Pipe:** ⅛ ips through 12" ips seamless and welded, schedules 5-80. **Fittings:** ⅛ ips through 4" ips, threaded and welding type. **Valves:** ¼ ips—2" ips. Also **mill shipments** of corrosion resistant items up to 48" OD. Send for FREE literature.

. . . in stock

C. A. ROBERTS CO. *Steel Tube Specialists*

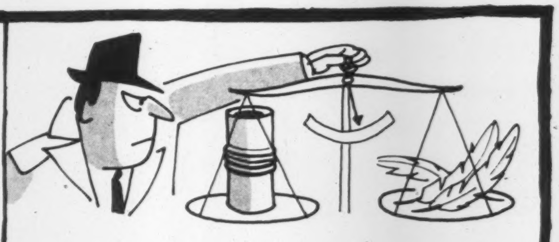
Dept. F-11 • 2401 25th Avenue • Franklin Park, Illinois

6 Warehouses serving the middlewest CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • TULSA • KANSAS CITY

HOW TO SLEUTH OUT THE TRUTH ABOUT EXPANSION JOINTS

1 **Case the joint (design, that is)**

Badger S-R Expansion Joints have: 1. Corrugations which assume "all curve" shape under pressure — low stress, long life. 2. Tubular rings allow flexing over more of corrugation height.

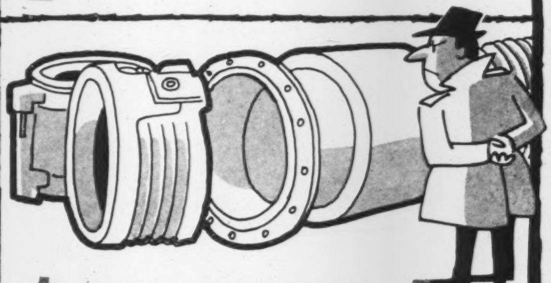


2 **"Weigh" the evidence**

S-R Joints have no bulky castings . . . weigh up to 50% less . . . diameter equivalent to pipe flange. Installation is easier, lighter supports required.

3 **Search for clues in fabrication methods**

Bellows are hydraulically formed to produce uniform corrugations with minimum thinning of material. Quality controlled longitudinal welding, no multiple circumferential welds.



4 **Remember to look for accessories**

Full line of accessories — including covers and liners. Easy to pick proper combination of model, type and accessories for any pressure, temperature, erosive or corrosive condition.

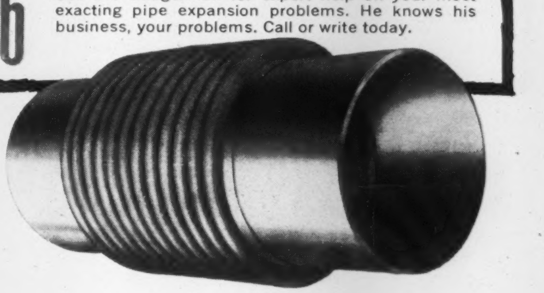
5 **Pull an M.O. on the manufacturer's background**

Badger's 50-year experience includes development of first successful self-equalizing design for higher pressures, temperatures. Badger has had more fabrication and engineering experience in more different applications than any other manufacturer.

6 **Close the case — buzz Badger**

See the Badgerman for expert help on your most exacting pipe expansion problems. He knows his business, your problems. Call or write today.

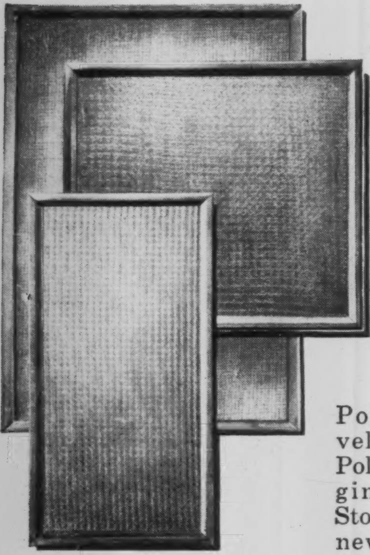
BADGER S·R
Expansion Joints



BADGER MANUFACTURING COMPANY
230 Bent Street, Cambridge 41, Mass.
Representatives in Principal Cities

© 1960 BMC

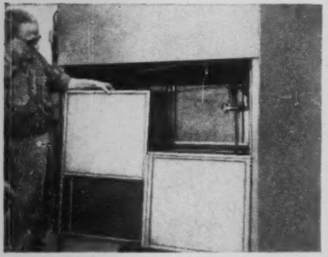
INSIST on Poly-Mag 80!



only in

DUST-magnet
FILTERS
a product of
STODDARD
INDUSTRIES

Just rinse, shake and replace . . . that's it.



Trap dust particles as small as 4/10 micron.

Cleaner, fresher, purer air means less housework.

Poly-Mag 80 is a newly developed, highly electrostatic Polyester plastic exclusively engineered and produced for Stoddard Industries. With this new material, DUST-magnet filters are now more effective in every way . . . higher resistance to shrinkage . . . lower pressure drop . . . unaffected by humidity, or temperatures up to 230° F.

There are more advantages to stocking and selling DUST-magnets than any other filter!

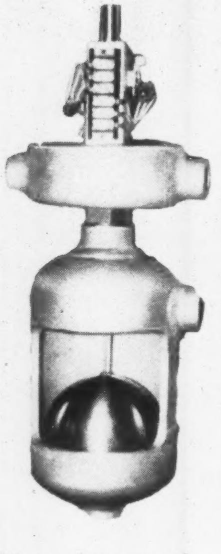
CUSTOMER SATISFACTION
They are guaranteed for the life of the unit in which used . . . cleaned in minutes with no messy oil coating needed.

RETAILER SATISFACTION
Customer satisfaction . . . standard sizes . . . excellent profit margin.

WHOLESALER SATISFACTION
Models are available for residential, commercial and industrial use . . . competitively priced . . . delivered promptly.

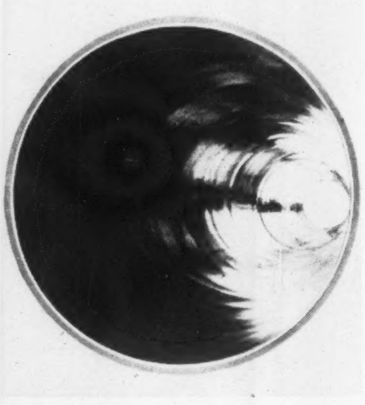
SERVICEMEN SATISFACTION
Reduce operating costs and improve efficiency of furnace and air conditioning systems . . . ease of installation.

DUST-magnet
FILTERS
a product of Stoddard Industries
3383 E. Layton Ave., Cudahy, Wis.



Liquid Level Control . . .

. . . for applications where vibration and corrosion conditions are present. Unit is a single-stage, external float cage style control. Can be electrically or pneumatically switch operated. *Magnetrol, Inc.*, 2110 *S. Marshall Blvd., Chicago* 23, *Ill.*



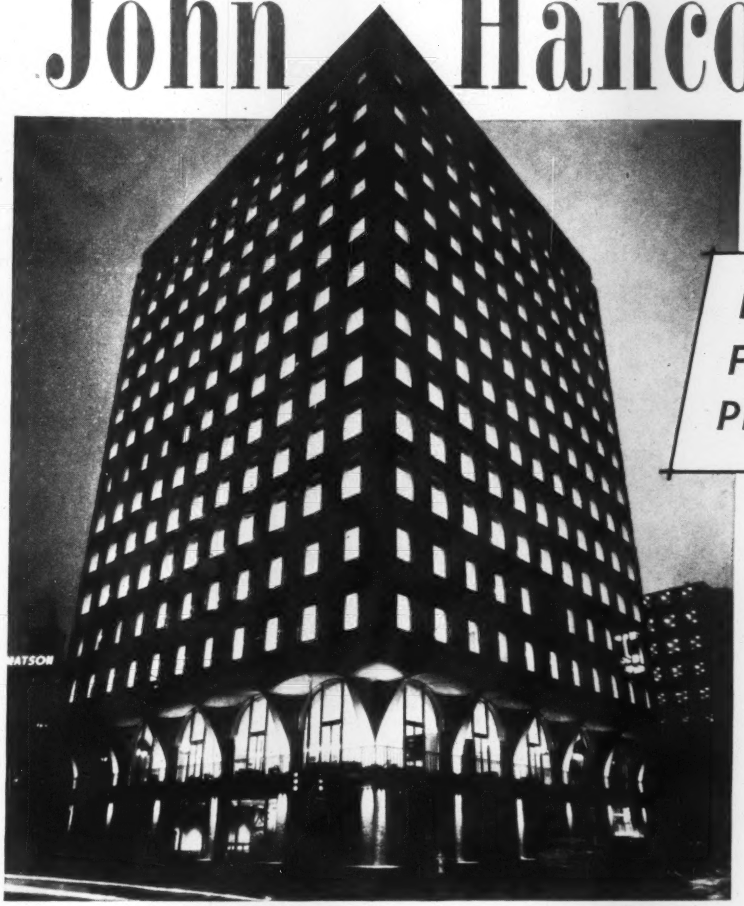
Bi-Metallic Pipe . . .

. . . corrosive resistant tubing for industrial applications. Seamless lining is hydraulically expanded inside base pipe; additional pressure expands the base pipe. On return to normal operating pressures, lining is held against base pipe due to differential contraction. Metals for both base pipe and lining can be specified. *Grayloc Sales Div., Grayloc Tool Co., P.O. Box* 2291, *Houston* 1, *Tex.*

Western Home Office, San Francisco

John Hancock

**Mutual Life
Insurance
Company**



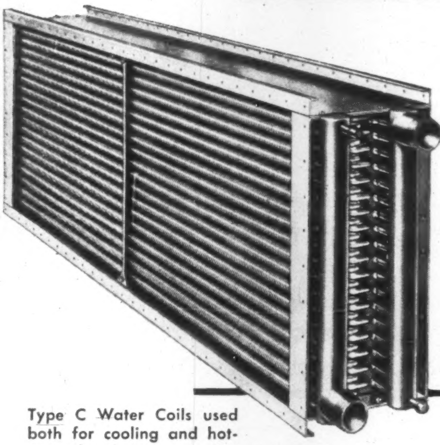
Designed for High Flexibility of the Physical Space Module

Skidmore, Owings & Merrill
Architects

Cahill Brother, Inc.
General Contractors

James A. Nelson Co.
Mechanical Contractors

AEROFIN INSTALLED



Type C Water Coils used both for cooling and hot-water heating

Modern smooth-fin design of Aerofin coils permits ample heat-exchange capacity in limited space—permits the use of high air velocities without turbulence or excessive resistance.

Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.

AEROFIN CORPORATION

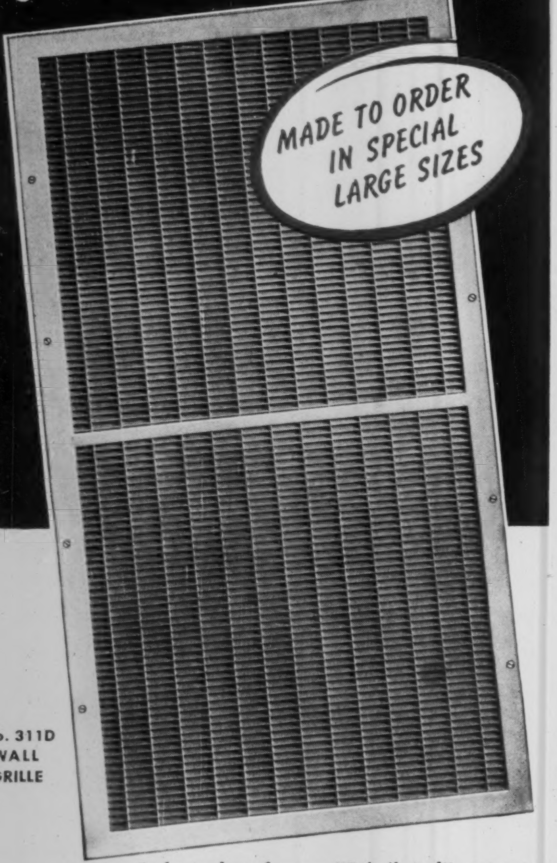
101 Greenway Ave., Syracuse 3, N.Y.

*Aerofin is sold only by manufacturers of fan system apparatus.
List on request.*

ENGINEERING OFFICES IN PRINCIPAL CITIES

For Commercial Installations

"Fabrikated"® WALL GRILLES



No. 311D WALL GRILLE

Independent famous "Fabrikated" construction makes these grilles especially adaptable to large sizes for schools, hospitals, hotels, and other commercial buildings.

CHECK THESE FEATURES:

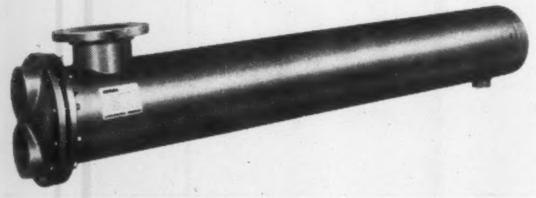
- ✓ Vertical or horizontal bars strengthened by interlocking cross bars; no vibration.
- ✓ Tamper-proof. Changes in air distribution cannot be made by unauthorized persons.
- ✓ Mesh (3/8 x 1 11/16) filters 72% of free area yet darkens the duct and reduces highlights from back of the grille.
- ✓ 14 gauge steel solid bars 1/2" deep—strong enough to be "kick-proof"—(a must for schools).
- ✓ All bars made from round edge stock. No sharp edges. (A must for schools).
- ✓ The only grille for taking abuse in school gyms and hospital psychopathic wards.

These grilles are unusually rigid-strong and exceedingly resistant to impact—the best that money can buy. We make them in any size. Send your specifications. We are prepared to give immediate service because we always stock grille parts for any size.

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET · CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS

Continued

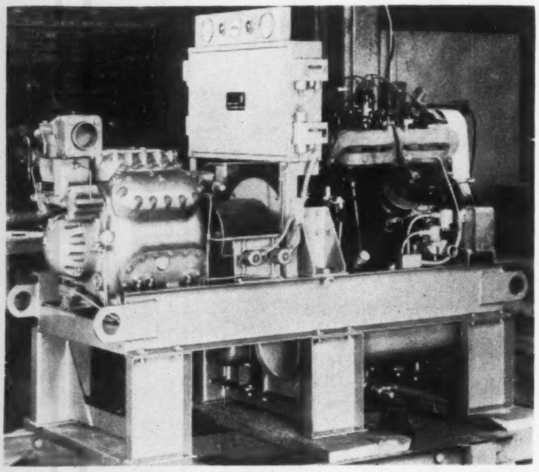


Steam Converter . . .

. . .primarily used for heating water with steam. When applied to high buildings, unit keeps static heads at reasonable levels. *Dunham-Bush, Inc., 179 South St., West Hartford 10, Conn.*

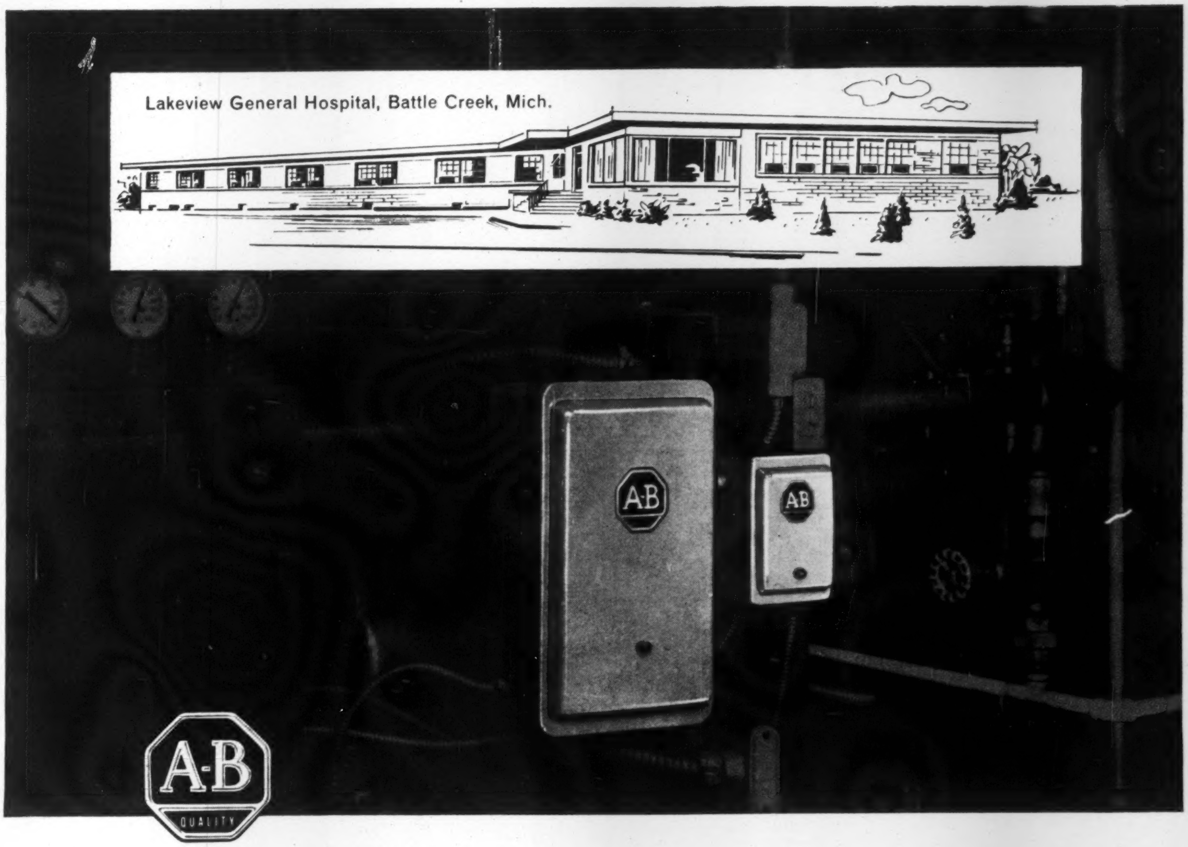
Air Wash Treatment . . .

. . .for air wash systems in textile mills and tobacco plants. Designed to remove sticky deposits in operating systems and to prevent further deposits. Surface active compound is compatible with standard corrosion and scale inhibitors and does not tend to create foam or froth. Available in 55 gal drums or 5 gal pails. *Dearborn Chemical Co., Dept. WT, Merchandise Mart Plaza, Chicago 54, Ill.*



Gas Motor Powered Drive . . .

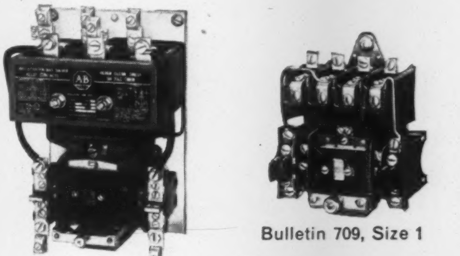
. . .for three basic cooling units: a package liquid cooler unit for water cooling systems (shown); a refrigeration condensing unit series; and an engine compressor unit. All parts, except gas motor, are made by one firm, simplifying acquisition of repair parts and reduces field maintenance. *Bell & Gossett Co., Market Development Div., Morton Grove, Ill.*



Lakeview General Hospital selects

ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROL

for expandable Air Conditioning System



Bulletin 709, Size 1

Bulletin 709, Size 3

A-B solenoid starters used in Acme packaged liquid chiller at Lakeview General Hospital. Bulletin 709 starters are available in ratings to 450 hp, 220 v; 900 hp, 440-550 v.

To stay within a limited budget, Battle Creek's Lakeview General Hospital decided to install their air conditioning system in steps and to keep it on a pay-as-you-go basis. Since costly maintenance would seriously hinder these plans, it was natural for Allen-Bradley trouble free motor control to be selected. Its simple solenoid design has only ONE moving part. With virtually nothing to go wrong, you are assured of *millions* of dependable and trouble free operations.

The double break, silver alloy contacts—used throughout the A-B line—are always in good operating condition, and remain so without servicing. In addition, all A-B starters have reliable and permanently accurate overload relays that provide protection against motor burnouts.

When planning with an eye to the future, insist on Allen-Bradley *quality* motor control—it will save you money over the long run.

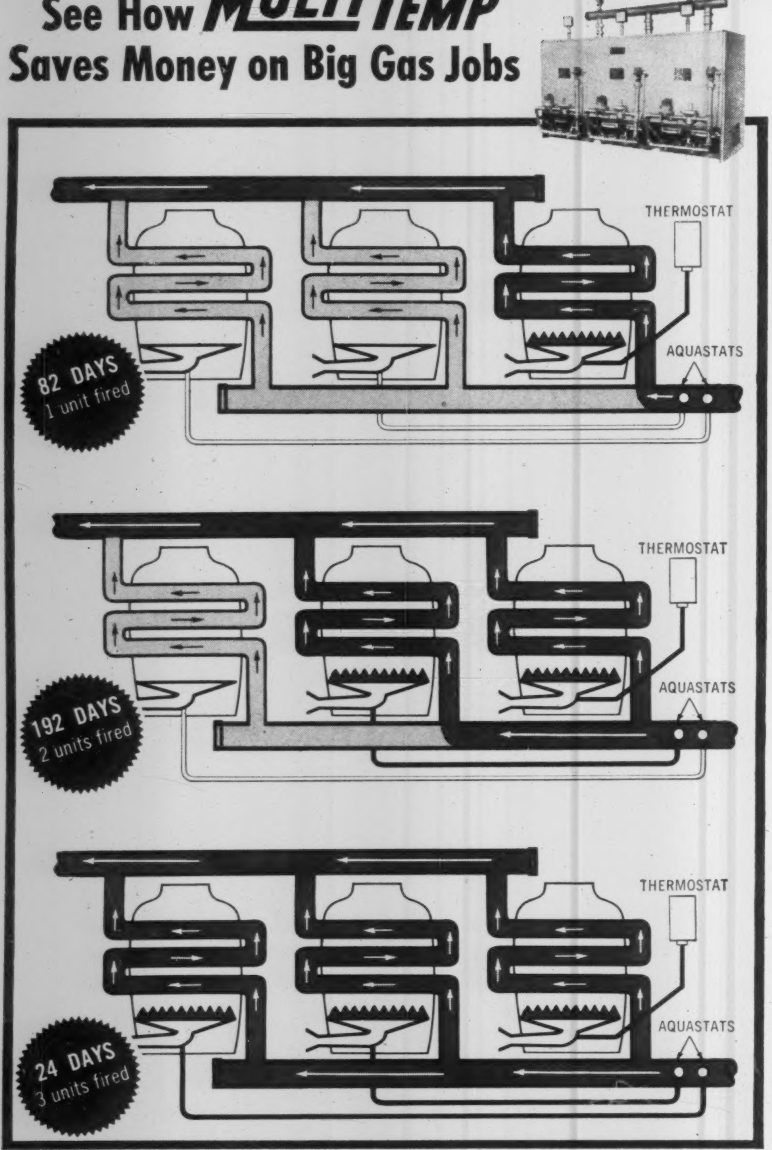
Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

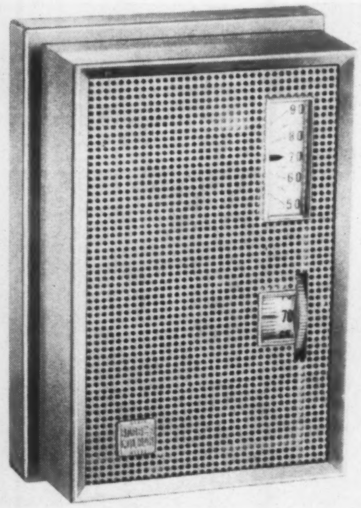
See How MULTITEMP
Saves Money on Big Gas Jobs



CUTS SHORT CYCLING, FUEL WASTE, INSTALLATION COSTS

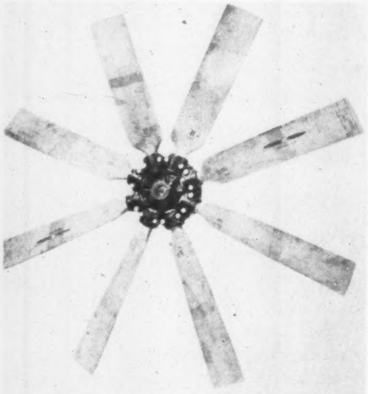
Diagram shows how cast iron MULTITEMP Hot Water Heating Plants automatically adjust capacity to load — save fuel dollars! Sensing elements in return water header call in additional combustion units, one-by-one, as temperatures drop. The load distribution shown is typical of our northeastern region. Note: full capacity was required during only 3% of heating season, and a single unit could meet demand for over 25% of season. Set-up time is saved too — batteries do not require field rigging or joining of sections — come factory assembled with controls. Maintenance is easy on individual units without service interruptions. Capacities up to 3,600,000 BTU/hr., rated at 100# ASME working pressure. For space heating and volume water heating. *Write for catalog HY-F107 today!*

HYDROTHERM INC
DEPT. 13-AC, NORTHVALE, NEW JERSEY
FIRST IN HYDRONIC GAS HEAT



Thermostats . . .

. . . enclosed by die-cast cover frame with textured metal face plate. Bi-metal thermometer with round set-point dial with 1 F graduations. Offered in two versions: Light duty units rated at 2.5 amp, 24 v; 1 amp, 120 v; and 0.5 amp, 240 v. Medium duty units rated at 1/3 hp at 120/240 v a-c. *Barber-Colman Co., Rockford, Ill.*



Industrial Fan . . .

. . . with one-piece heat treated blades made of an aluminum alloy containing 7 percent silicon and 0.3 percent magnesium. Light weight blades have high resistance to fatigue and corrosion; endurance limit is 13,000 psi. Ductile cast iron 16 in. hub allows maximum airflow around its periphery. *Koppers Co., Inc., Metal Products Div., 200 Scott St., Baltimore, Md.*

Keflex Manufacturing Division
U. S. Flexible Metallic Tubing Co.
Since 1905

KEFLEX

LAMINATED
STAINLESS STEEL BELLOWS
See Our Catalog in Sweet's Files

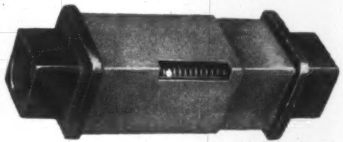
General Offices — 63 Main St.,
San Francisco 5, Calif.
Factories — Los Angeles —
San Francisco
Sales Offices — Agents in Principal
Cities of U. S. and Canada

KEFLEX QUADRA-SIDE EXPANSION COMPENSATORS
FOR STEAM AND HOT WATER HEATING SYSTEMS USED WITH CONVECTOR AND FIN TUBE BASEBOARD RADIATION UNITS IN SCHOOLS, HOSPITALS, OFFICES AND COMMERCIAL INSTALLATIONS

TYPE 7-Q square brass telescoping case protects laminated stainless steel bellows from torsion, squirm, misalignment and external damage. Compensators are used in high and low pressure hot water supply lines, risers and for baseboard radiation. Extra flexibility provides maximum cyclic life. Units are very compact and rugged. Sizes ¾" thru 3". Pressures to 300 PSI. Temperatures to 800°F. Traverse: Single Units, total 2" (1-½" compression, ½" extension) Dual units available.

TYPE 11 Q-T has heavy square telescoping case and laminated stainless steel bellows. For use in risers and with baseboard radiation. Test pressure 150 PSI, working pressure 100 PSI, temperatures to 300°F. Traverse: Total 1" (¾" compression, ¼" extension).

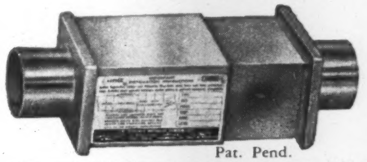
TYPE 7 Q WITH BRASS FEMALE THREADED ENDS
Working Pres. 300 PSI Maximum
Temp. 800 F



Pat. Pend.

Nom. I.P.S.	Overall Length	Max. O.D.	Wt. #
¼"-1.00"-1.25"	6.50"	2.00"	2
1.50	6.50	2.50	4
2.00	6.50	3.00	5
2.50	6.50	3.50	6
3.00	6.50	4.00	9

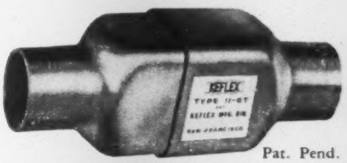
TYPE 7 Q-T WITH COPPER TUBE ENDS
Maximum Pres. 200 PSI Maximum
Temp. 300 F



Pat. Pend.

To Fit Copper Tubing		Overall Length	Max. O.D.	Wt. #
Nominal I.D.	Actual O.D.			
¾"	⅞"	6.50"	2.00"	1½
1	1⅛	6.50	2.00	1½
1¼	1⅜	6.50	2.00	1½
1½	1⅝	9.00	2.50	3½
2	2⅛	10.00	3.00	4½
2½	2⅝	10.75	3.50	5½
3	3⅛	11.50	4.00	8¼

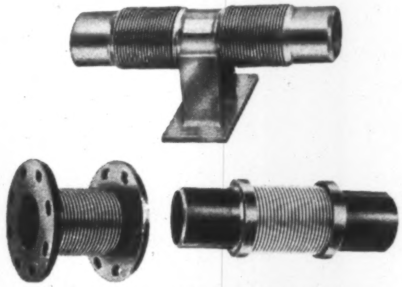
TYPE 11 Q-T WITH COPPER TUBE ENDS
Maximum Pres. 100 PSI Maximum
Temp. 300 F



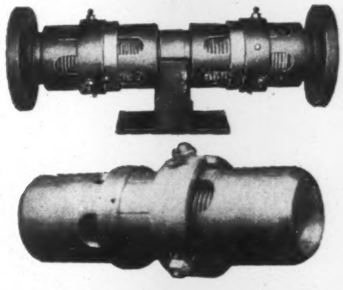
Pat. Pend.

To Fit Copper Tubing		Overall Length	Max. O.D.	Wt. #
Normal I.D.	Actual O.D.			
¾"	⅞"	4.50"	1.50"	1¼
1	1⅛	4.50	1.50	1¼
1¼	1⅜	4.50	1.75	1½
1½	1⅝	4.50	2.25	3
2	2⅛	4.50	2.75	4

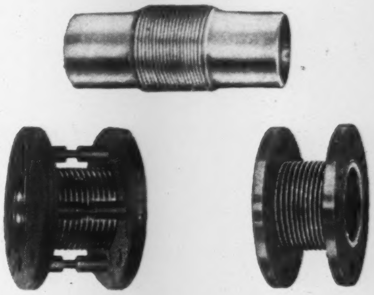
EXPANSION JOINTS—VIBRATION ABSORBERS—FLEXIBLE CONNECTORS—PIPE GUIDES
Force Required to Compress Keflex Expansion Joints Their Full Rated Traverse is Usually Less Than 100 Lbs., Total



KEFLEX EXPANSION JOINTS — corrugated, packless type for steam and hot water heating systems and process piping. Laminated stainless steel bellows with internal liner guides and stainless steel contour control rings. Weld ends, or flanges. Outside shrouds and intermediate anchor bases available. Sizes 2" through 48". Pressures 70 to 450 PSI. Temperatures to 800° F. Furnished for various required traverses.

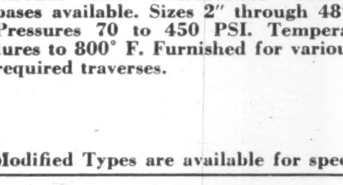


KEFLEX-KETROL CONTROLLED EXPANSION JOINTS — positive protection against torsion. For use in pipe lines to compensate for expansion and contraction. Shroud has intermeshing fingers providing concentric guiding and protection against squirm, torsion, and external damage to laminated stainless steel bellows. Designed for high pressure, high temperature hot water service. Movement is controlled by limit stops. Sizes 2" through 48". Pressures to 450 PSI and temperatures to 800° F.



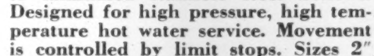
KEFLEX FLEXIBLE CONNECTORS AND VIBRATION ABSORBERS — to absorb vibration from pumps, chillers, and compressors. Serves to relieve stress on pump volute when piping is misaligned. Extra flexibility of laminated stainless steel construction produces long cyclic life. Compact units save space and are easy to install. Available with or without tie rods. Sizes 2" through 48". Pressures to 450 PSI and temperatures to 800° F.

Modified Types are available for special conditions requiring higher pressure, temperatures, traverse, or combination deflections.

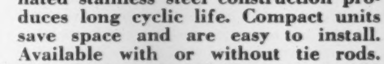


KEFLEX-MAVE TYPE M

Fabricated steel pipe guides for concentric guiding of pipe lines. Special insulated guides are available for chilled water.



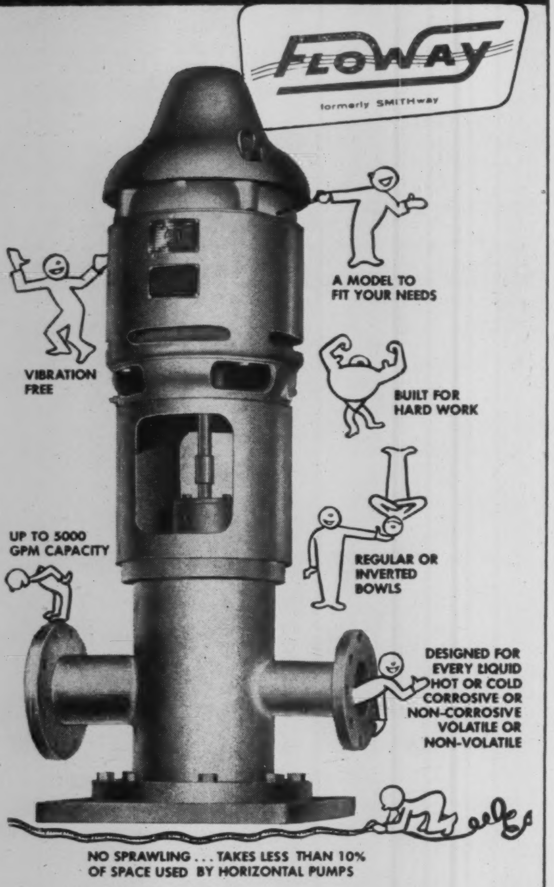
FLEXIBLE "BMH" CONNECTORS



"USF" BRONZE VIBRATION ABSORBERS

Braided bronze Metal Hose assemblies made in standard lengths. Usually used as flexible connectors on pumps and other mechanical equipment for heating and air conditioning service. Available with threaded male ends, flanges, and copper tube sweat ends.

VERTICAL TURBINE PUMPS


FLOWAY
formerly SMITHway
A MODEL TO FIT YOUR NEEDS
VIBRATION FREE
BUILT FOR HARD WORK
UP TO 5000 GPM CAPACITY
REGULAR OR INVERTED BOWLS
DESIGNED FOR EVERY LIQUID HOT OR COLD CORROSIVE OR NON-CORROSIVE VOLATILE OR NON-VOLATILE
NO SPRAWLING . . . TAKES LESS THAN 10% OF SPACE USED BY HORIZONTAL PUMPS

ALL THIS—
AND ECONOMY, TOO!

FloWay pumps are engineered for industry. In materials, design, construction, and versatility, they satisfy practically every industrial requirement. And in addition to obvious features, there is a built-in ruggedness that means low maintenance and long, economical service. Send for Bulletin #14 describing FloWay industrial pumps.

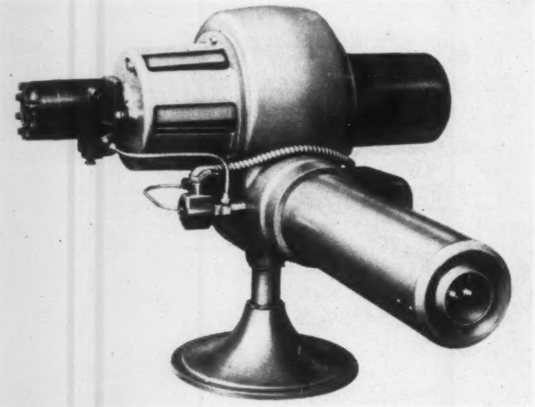
FLOWAY Pumps

MANUFACTURED BY
FIESE & FIRSTENBERGER MFG., Inc.
2494 Railroad Ave. Fresno, Calif.

Contact your FloWay distributor

Oakland, California
Pacific Pumping Company
San Francisco, California
Woodin & Little
Denver, Colorado
Harry J. Glass & Associates
Oakland Park, Florida
Peninsular Armature Works
Metarie, Louisiana
A. G. Kirkwood Co.
Detroit, Michigan
Detroit Air Compressor
Baltimore, Maryland
R. Thum & Company
Buffalo, New York
Ralph Simmons & Company
New York, New York
Frank A. Kristal

Cleveland, Ohio
W. J. Bryson Company
Tulsa, Oklahoma
The Kase Company
Portland, Oregon
Pacific Pumping Company
Ardmore, Pennsylvania
Warren E. Quillman
Pittsburgh, Pennsylvania
Weinman Pump & Supply Co.
Dallas, Texas
Livingston Machinery Co.
Houston, Texas
Pump & Power Engineering Co.
Seattle, Washington
Pacific Pumping Company



Oil Burner . . .

. . . for firing in narrow, low combustion chambers. Full firing capacity achieved in chamber 19 in. wide × 34 in. long × 18 in. high, with a floor-to-nozzle distance of 9 in. Firing range from 6 to 10 gph, and features a narrower, higher velocity air stream with conforming oil spray pattern. Listed by U.L. *The Carlin Co., Wethersfield, Conn.*

Moisture Condenser . . .

. . . for removing moisture from compressed air supplied to pneumatic control systems. Unit removes moisture before it enters control system piping and discharges it through automatic trap. Refrigeration unit has capacity to dry 10 cfm of air and produce a dew point of −8 F or lower when entering air is at a pressure of 50 psi and is saturated with moisture at 98 F. *Royse Mfg. Co., 4740 Vicksburg, Dallas 12, Tex.*

DeZurik Valves . . .

. . . so obviously right for air conditioning!

DeZurik Valves, with exclusive Eccentric Action, provide advantages you find on no other valve! Dead-tight shut-off . . . easy, quarter-turn operation every time, WITHOUT LUBRICATION . . . longer life . . . no chatter or whine . . . these features make DeZurik Valves so logical . . . so obviously right for air conditioning service.

For more information, see the DeZurik representative in your area, or write to

DEZURIK CORPORATION
SARTELL, MINNESOTA

DeZurik Valves supplied for air conditioning service are made of a close-grained nickel chromium alloy iron for high strength and good corrosion resistance. Resilient plug facings guarantee tight shut-off. Throttling characteristics are uniform throughout the operating range; the same valve can be used for shut-off or throttling. Straight-thru flow provides high capacity and low pressure drop with a minimum of turbulence.

DeZurik Valves can be supplied with a pressure gauge connection on the downstream side of the valve body for use in balancing. They can also be supplied in three-way and four-way models.

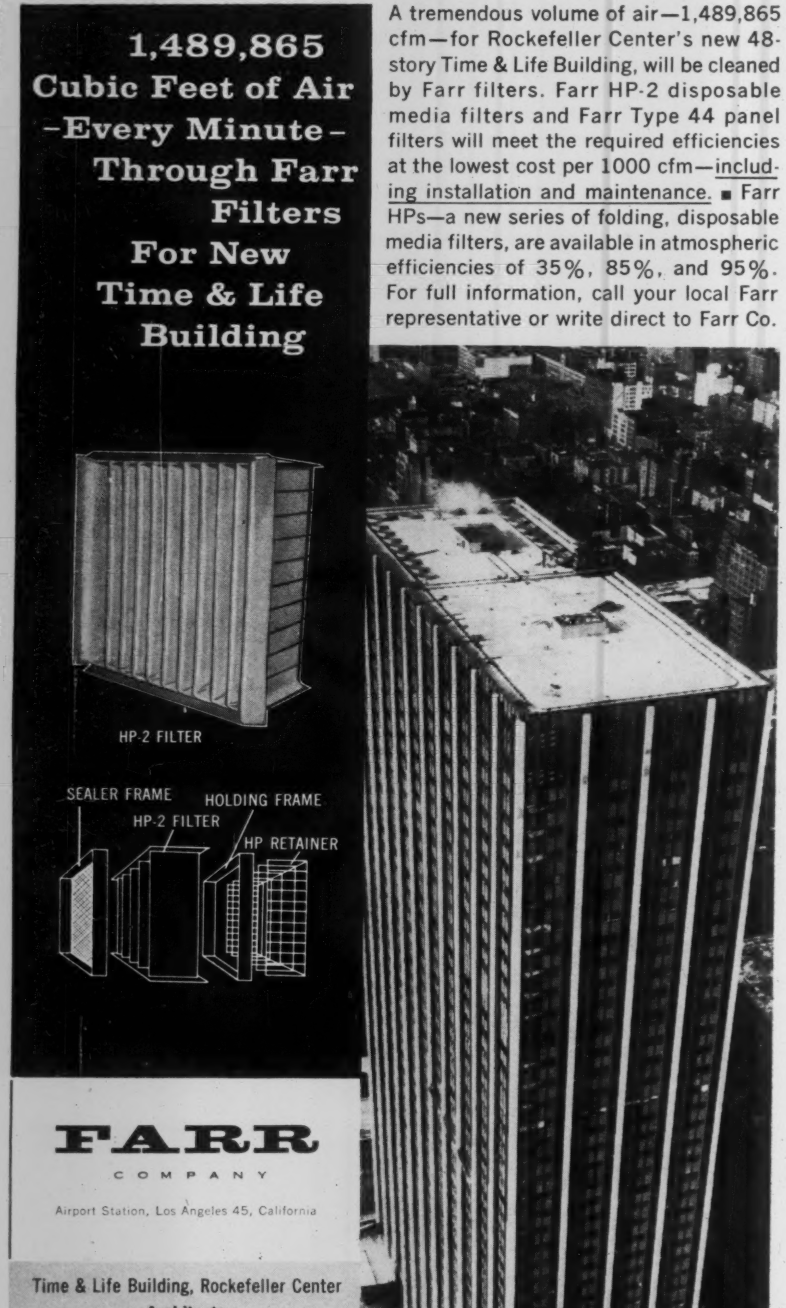
Typical applications include:

Chilled Water Balancing

Chilled Water Pump Shut-Off

Condenser Pump Shut-Off

Cooling Tower Shut-Off and others.



1,489,865 Cubic Feet of Air -Every Minute- Through Farr Filters For New Time & Life Building

A tremendous volume of air—1,489,865 cfm—for Rockefeller Center's new 48-story Time & Life Building, will be cleaned by Farr filters. Farr HP-2 disposable media filters and Farr Type 44 panel filters will meet the required efficiencies at the lowest cost per 1000 cfm—including installation and maintenance. ■ Farr HPs—a new series of folding, disposable media filters, are available in atmospheric efficiencies of 35%, 85%, and 95%. For full information, call your local Farr representative or write direct to Farr Co.

HP-2 FILTER
SEALER FRAME
HOLDING FRAME
HP-2 FILTER
HP RETAINER

FARR COMPANY
Airport Station, Los Angeles 45, California

Time & Life Building, Rockefeller Center
Architects:
Harrison & Abramovitz & Harris
Mechanical Engineer:
Syska & Hennessy, Inc.
Mechanical Contractor:
Almirall-Wolff & Munier—
A Joint Venture
General Contractor:
George A. Fuller Company
and John Lowry, Inc.

EQUIPMENT DEVELOPMENTS

Continued

OUTLET
INLET

Shutoff Valves . . .

. . . features full-flow passage and O-ring sealing. Units available with single inlet and outlet, single inlet and two outlets, and two inlets and single outlet. Stainless steel construction with 90 deg configuration. Operating temperature range from −40 F to 450 F; pressure range from 0-6000 psi with zero leakage. *Circle Seal Products Co., Inc., 2181 E. Foothill Blvd., Pasadena, Calif.*

-20
0
20
40
60
80
100
120
140
160
180
200
220
°F
ABBEON INCORPORATED
179-15 JAMAICA AVE.
JAMAICA 32 N.Y.
Made in West Germany

Thermometer . . .

. . . for measuring temperatures from −30 F to 230 F. Overall diameter is 7¾ in. with a 6½ in. diameter dial. Percentage of accuracy is within 1 percent over entire range. Information card sent on request. *Abrax Instrument Corp., 179-15 Jamaica Ave., Jamaica 32, N.Y.*

FLASH FIRE PROVES
VALUE OF NEW
FLAME RESISTANT
PAPER

The photograph above shows a ceiling section of a factory in Pennsylvania after a flash fire. A new kind of paper lamination was used as a moisture-vapor barrier under the roof. This paper is *self-extinguishing* when its combustion temperature is reached. The intense heat burned away one of the layers in the lamination allowing this self-extinguishing feature to work . . . thereby helping to contain an otherwise potentially destructive fire.

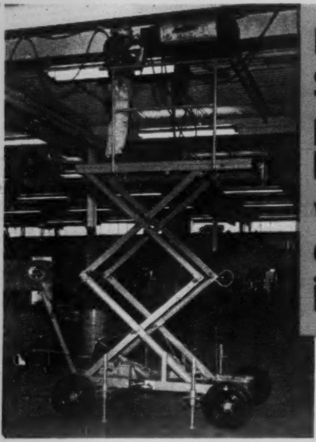
This flame resisting material carries a minimum Underwriters' Laboratories Flame Spread rating. Called Pyro-Kure®, it is a combination of paper, foil and/or plastic. Permanently non-combustible it has a perm rating of less than 0.1 and is being used as insulation facing, pipe jacketing, duct lining.

If this product suggests a possible answer to a problem in your firm, we will be glad to hear from you. Write to our main offices in Attleboro, Massachusetts.

SISALKRAFT

AMERICAN SISALKRAFT CORPORATION
Chicago 6 • New York 17 • San Francisco 5
In Canada: Murray-Brantford Ltd., Montreal

reinforced paper, foil and plastics for construction, industrial packaging and agriculture



NEW SKY WITCH puts load and workmen at job height!

Work height easily varied with a touch of the controls

Sky Witch, the new ***CHARLES*** *product, is a...*

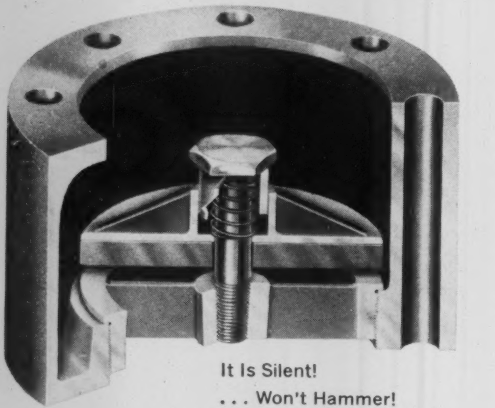
WORK-LOAD LIFT!

For construction, installation, and overhead maintenance . . . in industrial plants and commercial buildings . . . chemical plants, refineries . . . inside or outside! Sky Witch offers 6 basic models with various power and mounting options. Portable and hydraulic, it lifts the load and serves as an adjustable work platform . . . heights to 24 feet, loads to 2,000 pounds! Write for details.

CHARLES Machine Works, Inc.

1530 B. STREET • PERRY, OKLAHOMA • FE 6-4404

TAKE ANOTHER LOOK AT THIS CHECK VALVE



It Is Silent!
. . . Won't Hammer!
. . . Won't Slam!
. . . Eliminates Line Surges!

It's the one and only CPV SILENT CHECK VALVE

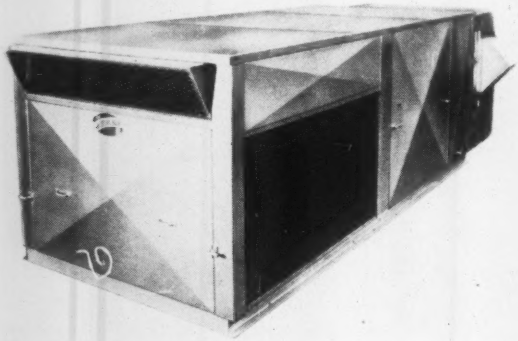
. . . your positive assurance of a safe, silent piping system. Want the full story? Write today for Catalog 600.

CPV

SILENT CHECK VALVES
COMBINATION PUMP VALVE COMPANY
851 Preston St., Philadelphia 4, Pa.

EQUIPMENT DEVELOPMENTS

Continued

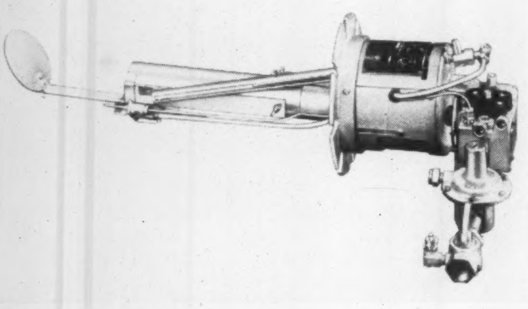


Pre-Fab Air Conditioner . . .

. . . roof mounted, year 'round unit has 17½ ton capacity. Other units in line range from 5 to 35 tons. Prefabricated supply and return distribution chambers supplied with units. No field assembly necessary. Universal heater section with oil or gas-fired exchangers. *Air-Conditioning, Inc., 88 N. Highland Ave., Ossining, N. Y.*

Liquid Level Control . . .

. . . for commercial and industrial applications. Allows selection of a variety of settings within one of several ranges. Available with non-corrosive parts and can be supplied with a built-in time delay mechanism for accurate control of agitated liquids. *Controls Co. of America, Appliance and Automotive Div.,* 9555 *Soreng Ave., Schiller Park, Ill.*



Gas Conversion Burner . . .

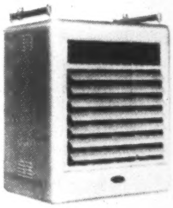
. . . for converting oil-fired furnaces and boilers to gas heat. Tubeless cast iron inshot unit features an adjustable cast iron venturi. Choice of 24 v or self-generating controls ranging in size from ½ to 1 in. Minimum input rating is 50,000 Btu per hr; maximum rating from 160,000 to 225,000 Btu per hr with natural or mixed gas; from 105,000 to 225,000 Btu per hr with manufactured gas. *The Adams Mfg. Co.,* 1530 *St. Clair Ave., Cleveland* 14, *O.*

You Bet...

I'm A "HEAVY-WEIGHT"

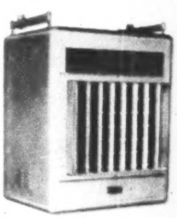
Hastings
GAS UNIT HEATERS

Guaranteed For 10 Years
Because They Are 50% Heavier
Than The "Light-Weights"



FAN and BLOWER TYPES

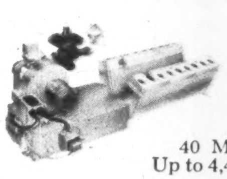
Complete Range of Sizes
25,000 to 300,000 Btu.
Aluminized or Stainless
The Only Heaters Built To Duct Furnace Standards
For All Types of Gas



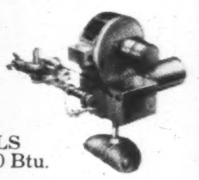
DUCT FURNACES

From 75,000 to 300,000 Btu.
Sectional Models For Close-Coupling to 1,200,000 Btu.
Aluminized or Stainless Steel Heat Exchangers
Models For Down-Stream
Adjustable Air By-Pass

COMPLETE LINE OF GAS POWER BURNERS



ADJUSTO "V"



INSHOT

40 MODELS
Up to 4,400,000 Btu.

Compare These "HEAVY WEIGHT" FEATURES

Duct Furnaces for Down-Stream Use
Adjustable Air By-Pass
Aluminized or Stainless Steel
Enclosed Blower Models
Stainless Steel Ribbon Burners
4-Way Air-Distribution Louvers
"Easy-Balance" Hangers
Optional Dual-Fuel
Modulation or 2 Stage Controls

GAS UNIT HEATERS
Hastings
GAS POWER BURNERS

Write for Prices and Catalogs
HEATERS: Bulletin H-11-G **BURNERS: H-11-B**

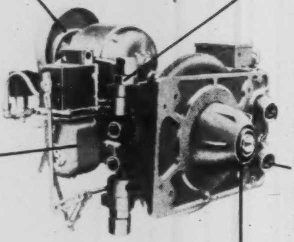
HASTINGS AIR CONTROL, Inc.
OMAHA 5, NEBR.

these ENTERPRISE features

—are YOURS for

BIGGER BURNER SALES

—AND HIGH CUSTOMER SATISFACTION!



V-BELT DRIVE—EXCLUSIVELY

ENTERPRISE pioneered V-Belt drive for Horizontal Rotary Oil Burners. For 15 years they have been used *exclusively,* for greater efficiency, flexibility and economy!

LEAK-PROOF HINGE DESIGN

New burner hinge does away with troublesome, leaky packing glands. "O" rings provide for positive, long-life sealing at this critical point!

"MEASURED-RATE" METERING PUMP

Provides for *exact* delivery of the *proper* quantity of oil to the burner—regardless of changes in temperature and viscosity. Another ENTERPRISE first!

VENTURI-TYPE IGNITER

Preferred for automatic starting, the ENTERPRISE igniter produces a clean, torch-like flame that eliminates carbonizing, provides failure-proof ignition.

"ANGLE-VANE" AIR NOZZLE

Provides full flame pattern control and efficiency regardless of firebox size and shape!

QUALITY PLUS ENTERPRISE SERVICE—THE RIGHT COMBINATION FOR CONTINUED SUCCESS

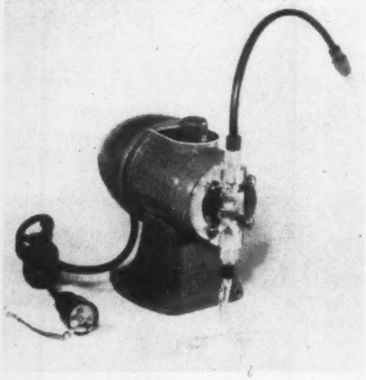
ENTERPRISE delivers the "plus" factors that ring up sales, profits and satisfied customers—the key to continued success for ENTERPRISE distributors and dealers. Now is the time to find out about ENTERPRISE—the profit line in commercial and industrial burners. Write today for information.

ENTERPRISE ENGINE & MACHINERY CO.

The Choice of Heating Experts

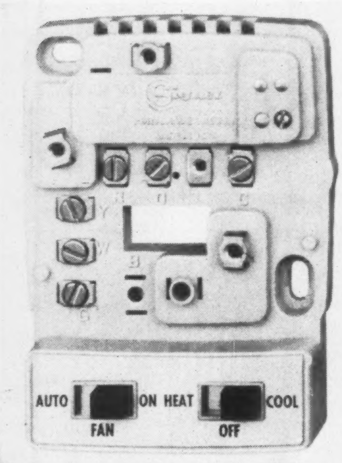
ENTERPRISE
DEPENDABLE BURNERS

Adel Division, General Metals Corporation • 1444 Washington Ave., Huntington 1, W. Va.



Solution Feeder . . .

. . . for commercial water well systems, cooling tower systems, and other applications. "No. 88" operates on 115 v motor and will introduce treatment into any line under suction, or up to 100 psi pressure. Unit is made of corrosion resistant parts to allow outdoor operation in rain and snow. *Calgon Co., Hagan Center, Pittsburgh 30, Pa.*



Thermostat Sub-Bases . . .

. . . for controlling combination heating-cooling systems with single-pole, double-throw thermostats. Designated "Q200" series, units have built-in thermal relay, which, with the system switch in proper setting, will start the cooling system when the thermostat contacts open on a temperature rise and stop it when the contacts close on a temperature drop. *Signet Controls, 3205 S.E. 13th Ave., Portland 2, Oreg.*

question of the month

Continued from page 106

in return lines or other parts of the system which are corroded and correct the conditions causing this.

During the heating season, maintenance operations should include a periodic check of the boiler water for strength of compound, a trial operation of the low-water cut-off, and a check of the safety or relief valve.

In the first year of service, draining, wash-out, and inspection should be performed after about 3 months of service. A receiver, if installed, should be checked occasionally to see that it does not overflow in service.

The strength of the boiler compound may be easily checked by the use of the test paper mentioned earlier.

If no sign of corrosion appears after this first check, the boiler may be left on the line for 6 months before the next washing, flushing, and examination. If it is still free of corrosion, then it may be used for a full heating season in subsequent years unless there is reason to suspect corrosion.

The boiler may be drained and washed at the end or shortly before the beginning of a regular heating season. Whenever it is done, it is extremely important to add a charge of boiler water treatment and steam the boiler or otherwise increase the temperature to at least 200 F immediately. This will drive off the dissolved gases and minimize the likelihood of corrosion from that source.

Many operators fill the boiler to the top after this short period of heating to eliminate the space which could trap air above the water line.

At the end of the season, a careful external inspection should be made, tubes scraped clean to the metal, heads and other plate surfaces brushed clean, and smoke boxes cleaned out. Tubes and other heating surfaces should be swabbed with neutral oil and required painting should be taken care of at the same time. If the boiler room is likely to be wet, corrosion prevention requires frequent inspection and, if necessary, the addition of some moisture absorbing material like calcium chloride or slate lime.

Boilers should be left full during lay-up unless there is danger of freezing.

If washing was performed at the end of the last heating season, then about the only attention needed before start-up is to drain down to the normal water line. If the boiler has been laid up dry, then refilling, adding compound, and boiling should be all that is required at the start of the heating season.

JOHN W. TURNER
Consulting Engineer

FOR **SIMPLIFIED INSTALLATION**

AND **COMFORTABLE ROOM HEAT**

USE **SHAW Panel-Vectors**

Cut-open view of Model A Panel-Vector

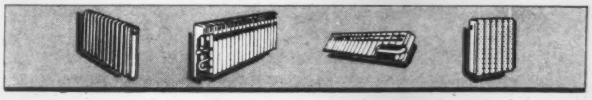
Shaw Panel-Vectors are of rigid, fully-integrated construction, delivered ready to install. There are no dampers or separate housings to fit and hang. Choice of same end or opposite end tapping offers opportunities for important piping simplification and economies.

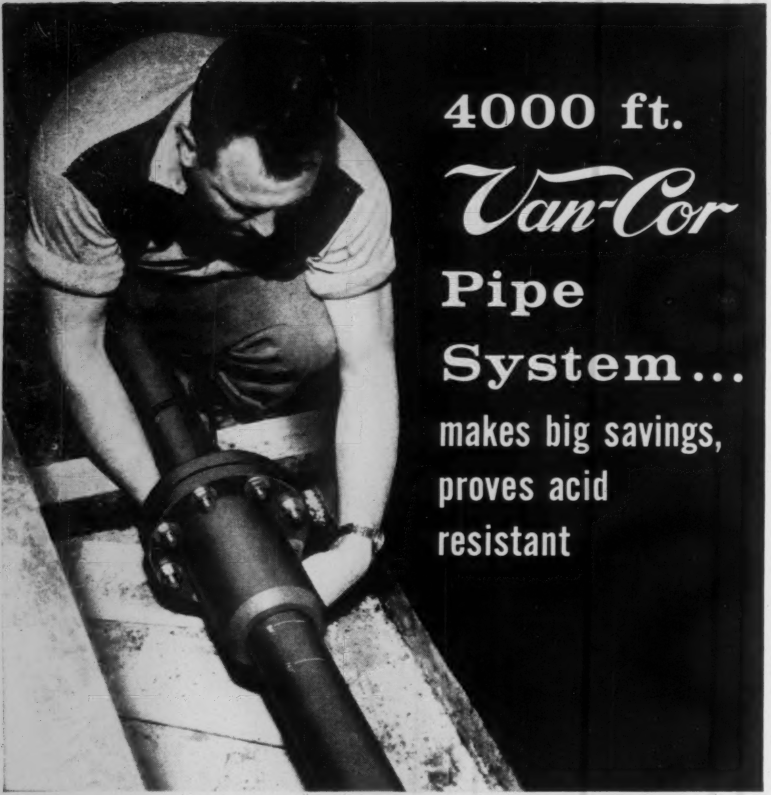
Panel-Vectors distribute a *low-temperature*, unvarying combination of radiant and convected heat that only Nature—at her best—can rival. Stratification, and areas of extreme heat or chill are eliminated . . . room occupants are not only warm, they are *comfortably* warm.

Shaw Panel-Vectors use hot water or steam up to 150 psi. They are available in wall-hung (panel) or baseboard models, each a space-saving 3″ deep. There is a full range of sizes to meet any room-heat distribution requirement.

Find out today about Shaw Panel-Vectors—the radiators that give you simplified installation, give the owner *comfortable* heat. Write for free literature on wall-hung and baseboard models.

SHAW-PERKINS MFG. CO.
Properly Designed Room Heat Distribution Equipment
201 E. CARSON ST., PITTSBURGH 19, PENNA.





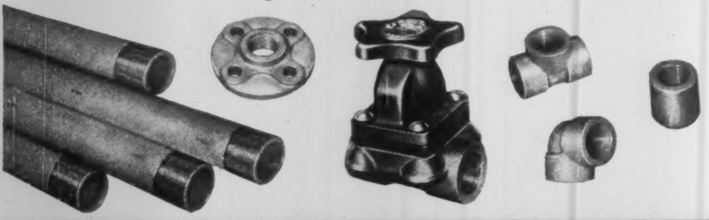
At the Allentown (Pa.) Works of the Western Electric Co., the entire waste acid disposal system in the recent addition consists of Van-Cor rigid PVC pipe and fittings.

HOW COSTS WERE CUT. Initial price of Van-Cor was ⅓ that of comparable cast iron alloy pipe. On a 6″ line, labor costs were estimated at 29¢ per foot of run—about half that of metallic pipe. Also, because Van-Cor has only 1/10 the weight, no mechanized handling equipment was needed. Available in 10 or 20 ft. lengths, Van-Cor requires fewer joints, and eliminates the breakage problem.

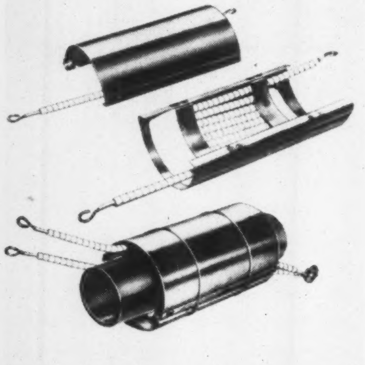
CORROSION LICKED. Van-Cor pipe was used because "corrosion resistant" cast metallic pipe had performed short of expectations in an adjacent building. After 1½ years service, the Van-Cor system is in excellent shape, unaffected by such acids as hydrofluoric, hydrochloric, sulphuric, nitric and many plating solutions.

Investigate Van-Cor Pipe, Fittings, Valves, Electrical Conduit, and Fabrications . . .

Write for Catalog and Name of Nearest Distributor

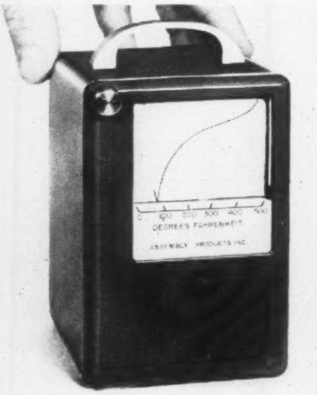


INDUSTRIAL DIVISION OF . . .
COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO



Stress Relief for Welds . .

. . . with resistance heating units that handle a number of welds at a time through one controlled power source. Two clamp-on units available: model "NV-C," a low voltage, high current heater for use on pipes or tubes from 2 to 4 in. OD, with wall thickness of ⅜ in. or less; model "Class 712" for higher voltage use on pipe from 1 to 2¾ in. OD inclusive, and for treating six welds at a temperature of 1375 F. Literature sent on request. *Electric Arc, Inc., 152 Jelliff Ave., Newark 8, N.J.*



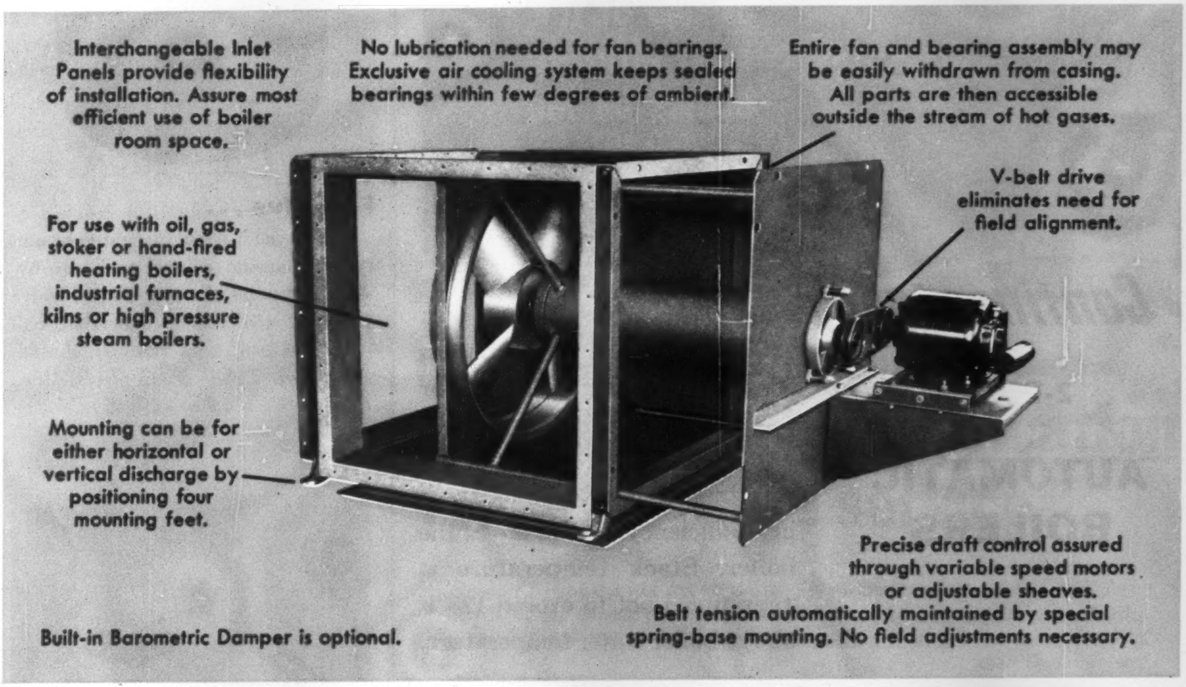
Temperature Recorder . . .

. . . miniature unit operates directly from a thermocouple, without signal amplication. Minimum temperature span covered is 0 F to 500 F; maximum span is 0 F to 2500 F. Accuracy is ±2 percent of full scale. Standard chart speed is 1 in. per hr; other speeds available. *Assembly Products, Inc., Chesterland, O.*

WHY USE DRAFT INDUCERS?

Because:

- Draft inducers permit the use of short stub stacks eliminating the costs and unreliable operation of tall stacks.
- Draft inducers maintain slightly negative in-boiler pressure which prevents gas or fumes leaking into the boiler room.
- In small unattended boilers, draft inducers minimize the danger of gas accumulations on blowouts.
- Draft inducers, by providing uniform draft at all times, permit closer adjustment of burners than would be possible otherwise for complete and economical combustion.



Interchangeable Inlet Panels provide flexibility of installation. Assure most efficient use of boiler room space.

No lubrication needed for fan bearings. Exclusive air cooling system keeps sealed bearings within few degrees of ambient.

Entire fan and bearing assembly may be easily withdrawn from casing. All parts are then accessible outside the stream of hot gases.

V-belt drive eliminates need for field alignment.

For use with oil, gas, stoker or hand-fired heating boilers, industrial furnaces, kilns or high pressure steam boilers.

Mounting can be for either horizontal or vertical discharge by positioning four mounting feet.

Precise draft control assured through variable speed motors or adjustable sheaves.

Belt tension automatically maintained by special spring-base mounting. No field adjustments necessary.

Built-in Barometric Damper is optional.

WHY CHOOSE WING DRAFT INDUCERS?

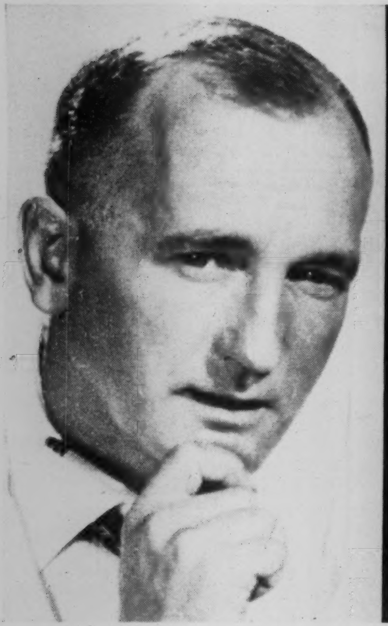
Because:

- Wing Draft Inducers take far less room and are much easier to install in any position than centrifugal units.
- Wing Draft Inducers have led the field for over ten years.
- Wing's experience guarantees a draft inducer that is constructed to provide really long and trouble-free life.
- Wing Draft Inducers provide the unique, easy-access feature. The fan and drive equipment may be withdrawn from the housing for cleaning and maintenance without disturbing breeching connections.

WING

L. J. WING MFG. CO.
DIVISION OF AERO SUPPLY MFG. CO. INC.
LINDEN, NEW JERSEY
FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA

WC 140



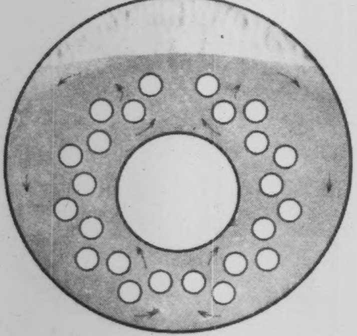
"... it is properly rated as one of the most efficient boilers on the market."

Continental

2-PASS

AUTOMATIC BOILERS

EFFICIENCY of the 2-Pass Continental Boiler means that you get guaranteed 80% minimum efficiency on every oil, gas or combination use of fuel. With its simplified 2-Pass design, the Continental delivers sustained high efficiency for the life of the boiler. Stack temperature is guaranteed not to exceed 125°F above boiler water temperature.



BALANCED HEAT DISTRIBUTION. *An important reason for Continental high efficiency and long service life is equal spacing of return tubes around centrally located furnace. Large areas between tubes, furnace and boiler shell provide rapid, unimpeded water circulation, faster heating and unrestricted steam release. No Continental Boiler has ever suffered damage or failed due to "thermal shock."*

Write for details of new boiler Leasing Plan and Bulletin BE-400.

CONTINENTAL BOILER Division
BOILER ENGINEERING & SUPPLY CO., Inc.
Phoenixville, Pennsylvania
Nationwide Sales and Service in Principal Cities

EQUIPMENT DEVELOPMENTS

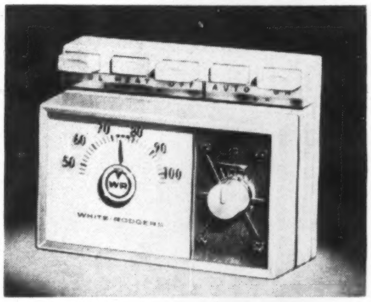
Continued

Fill Valve . . .

. . . with a pressurized diaphragm type expansion control tank for hydronic systems. Bronze bodied valve provided with union connection, ball check, screen, and manual shutoff. *American Tube & Controls, Inc., Pulaski St., W. Warwick, R.I.*

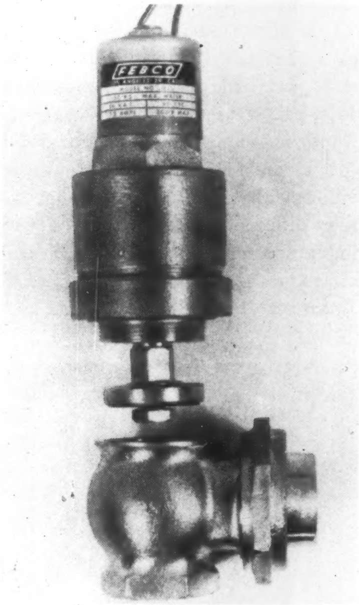
Welding Gun . . .

. . . with wire feeder for use with gas-shielded metal-arc welding process. Gun has 60 deg goose-neck nozzle assembly and lever type trigger, and can be used with buried arc and sprayarc welding using carbon dioxide as a shielding gas, as well as the standard gas-sheltered method using argon. Wire feeder has adjustable speed of up to 600 in. per min, and operates on 115 v, 60 cycle a-c. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 150 E. 42nd St., New York 17, N.Y.*



Thermostat . . .

. . . push button control of heating, cooling, and ventilating operations. Eight different switching combinations. Sealed mercury contacts. Unit is 3½ in. high × 4½ in. wide × 1⅞ in. deep. Folder "R-1691" sent on request. *White-Rodgers Co., 1209 Cass Ave., St. Louis 6, Mo.*



Valve Adapter . . .

. . . for converting manually operated process and control valves to automatic units. Adapter works with present piping and valve bodies so that lines in overheads, walls, floors, and equipment need not be disturbed. Units operated electrically or hydraulically, and are available for converting most standard globe valves in present use. *Febco, Inc., 1993 Blake Ave., Los Angeles 39, Calif.*

Binks 4-B cooling towers

hot-dipped
galvanized after fabrication for years more service

Now . . . Binks adds extra years of life to an already rugged, dependable cooling tower.

New 4-B series

Now . . . blowers, tower casings, basin . . . all parts subjected to corrosive action, weather and temperature changes are hot-dipped galvanized *after they are fabricated.*

No paint . . . no other coating material offers such long-lasting positive protection. And . . . hot-dipping after fabrication insures that there is no break in this protective armor.

High performance

Season in and season out, Binks towers are always more than a match for the specified cooling load. Motors, whisper-quiet squirrel cage blowers, decking and water dispersal ratios are all properly balanced for top efficiency.

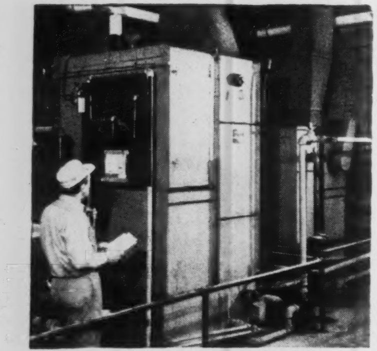
Get complete specifications Ask for Binks Bulletin 478. Contains dimensions, capacities and other specification and performance data.

Binks
EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED ☎ DIRECTORY



DRY and CLEAN AIR at the RIGHT TEMPERATURE

- to control your product quality
- to protect a critical operation
- to protect apparatus from moisture damage
- to DRY your material or product
- to control packing or storage conditions
- to assure precision in testing or research
- to increase air conditioning capacity

Air Condition by the NIAGARA Method Using HYGROL Liquid Absorbent

This compact method, giving high capacity in small space, removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the air.

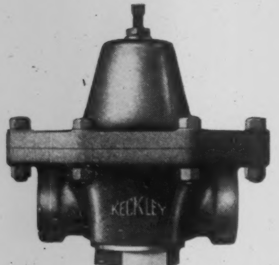
Most effective because... it removes moisture as a separate function from cooling or heating and so gives a precise result, and always. Niagara machines using liquid contact means of drying air have given over 20 years of service. The apparatus is simple, parts are accessible, controls are trustworthy.

*Most reliable because...*the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions... no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

*Most flexible because...*you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Write for Bulletins 112 and 131 and complete information on your air conditioning problem.

NIAGARA BLOWER COMPANY
Dept. HP-11, 405 Lexington Ave., New York 17, N. Y.
Niagara District Engineers in Principal Cities of U. S. and Canada



MORE VALVE FOR LESS MONEY

New! Pressure reducing valve — full ported orifice

The new Keckley No. 11A and No. 11R pressure reducing and relief valves feature a full ported orifice for greater capacity and increased flow of steam, air, water, oil and gas applications.

This enables the No. 11A and No. 11R to fit many applications presently requiring larger ordinary and/or more expensive valves at substantial savings.

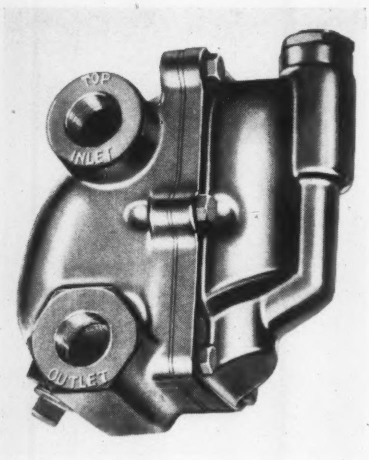
This single seated No. 11A and No. 11R has a semi-steel body, bronze or stainless steel trim and composition disc; and are suitable for initial pressures up to 250 lbs. steam, 450° F.: 500 lbs. water, oil and gas, non-shock, 100° F. Reduced pressures range from one pound to 100 lbs. Sizes ⅜" to 2".

Write for Bulletin No. 60

O. C. KECKLEY COMPANY
General Offices and Factory
3400 CLEVELAND ST., SKOKIE, ILLINOIS

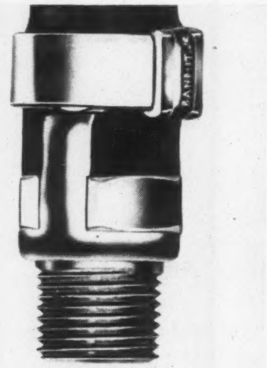
KECKLEY

Pressure Regulators • Temperature Regulators • Float Valves
Strainers • Solenoid Valves • Reducing Valves
Pop Safety Valves • Relief Valves



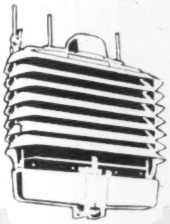
Steam Traps . . .

. . . for process steam applications ranging from 15 to 150 psi. Float type series "M27" drip trap, available with or without thermostatic air bypass, maximum pressure 15 psi. Series "M78" thermostatic traps, available in angle pattern only, 150 psi. Series "M80" float type traps, available in three sizes with ¾, 1, and 1¼ in. connectors provided with interior mechanisms for five different pressure ranges with maximum of 150 psi. Booklet sent on request. *Modine Mfg. Co.,* 1500 *DeKoven Ave., Racine, Wis.*



Hose Couplings . . .

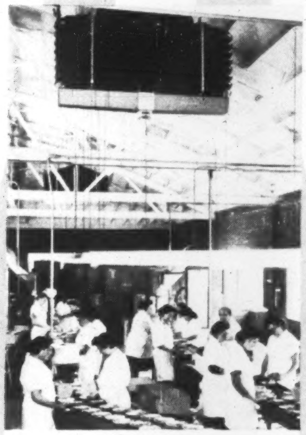
. . . in five sizes to fit any OD: ¼, ⅜, ½, ¾, and 1 in. ID. Hose nipple assembly locks in three places in addition to standard methods. Available in American or British taper pipe threads. *Band-It-Co.,* 4777 *Dahlia St., Denver* 16, *Colo.*



Bring Sun-Like Heat Into Your Plant With

PANELBLOC

OVERHEAD GAS-FIRED HEATERS



Panelbloc infra-red radiant heaters generate the same type of healthful, warming ray the sun does. Like the sun, it warms anyone and anything in its effective range. Panelbloc warms floors, furniture, machinery and people, NOT the surrounding air.

Panelbloc is low in first cost and easy to install. No electrical connections are needed. There are no fans, motors or blowers. No moving parts mean nothing to wear out.

Panelblocs use any commercially available gas for fuel and are automatic. AGA and UL approved.

Write for Bulletin PC 1-60 H today

PANELBLOC DIVISION
The BETTCHER MANUFACTURING CORPORATION
3106 West 61st St. Cleveland 2, Ohio

EQUIPMENT DEVELOPMENTS

Continued

Water Circulator . . .

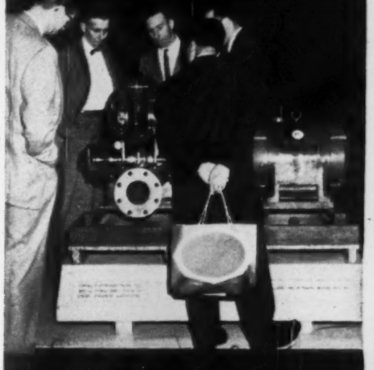
. . . horizontal unit available in $\frac{3}{4}$, 1, $1\frac{1}{4}$, and $1\frac{1}{2}$ in. sizes of interchangeable flanges. Rubber insulating sleeves at the flange bolts prevents metal-to-metal contact, permitting quiet operation. *H. A. Thrush & Co., Peru, Ind.*

Solenoid Valves . . .

. . . direct-lift units designed for operation from 0 to 1500 psi. Leakproof and packless. Available in bronze or stainless steel in $\frac{1}{4}$ to 1 in. pipe sizes for temperatures from −350 F to 450 F. Bulletin "S-2" sent on request. *Atkomatic Valve Co., 545 W. Abbott St., Indianapolis, Ind.*

WHAT'S BUILDING UP IN

PUMPS AND COMPRESSORS?



Often regarded as the "heart" of a system, pumps and compressors merit frequent re-evaluation to determine that you are using the right machine for a specific application.

Listening to the "heartbeat" of pumps and compressors can best be done at the Power Show, where you can ask questions, investigate and compare, get first hand answers from the manufacturers themselves. There you'll also see a broad line of other power and allied equipment.

At the Power Show you'll be in direct contact with manufacturers, enabling you to get specific, direct, authoritative answers to your questions. Only at the Show will you see more than 250 leading suppliers' products, all conveniently grouped together.

Make sure you're there. Everyone else will be!

2448

24th NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING
AUSPICES ASME
NEW YORK COLISEUM
NOV. 28—DEC. 2, 1960

MANAGEMENT: INTERNATIONAL EXPOSITION COMPANY
480 Lexington Ave., New York 17, N. Y.

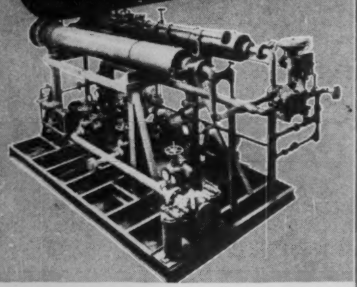
save on installation and maintenance

with

EAGAN

"pre-packaged"

FUEL OIL PUMP and HEATER SETS



Use an Eagan "pre-packaged" fuel oil pump and heater set for the preparation of heavy oil for combustion. You save time and money because units are completely assembled, ready for immediate installation. Only connections to oil and steam supply, burner, by-pass and relief lines have to be made and you avoid the combustion difficulties so often caused by field assembled combinations.

Here are additional benefits Eagan gives you:

- Generous reserve capacity, at least 50% over peak burner demand, allows for eventual wear and future demand increases.
- Maintenance is easy and at a minimum. Parts requiring service are easily accessible.
- "Honest", solid construction, excellent engineering assure long life, trouble-free operation.
- Compact units save space.

EAGAN fuel oil pump and heater sets heat to 300° F, pump to 400 psi and have capacities to 3000 gph. Single or duplex units are available for steam or electric drive. Duplex "electro-steam" sets provide for electrical failure by incorporating one steam pump and one electric motor driven pump. Other EAGAN sets can be made to your special requirements.

Write, wire or call for further information or let us bid on your job.

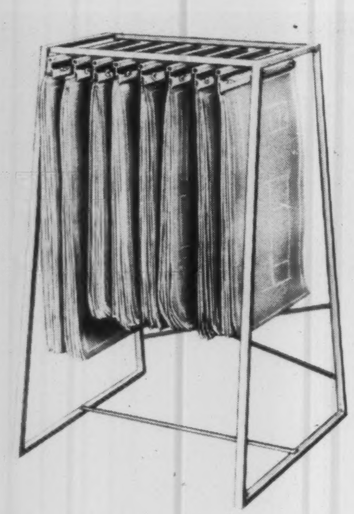
WALTER H. EAGAN CO., INC.
2337 Wallace Street, Phila. 30, Penna.
CEnter 6-2300

Mfrs. of condensate, boiler feed, turbine, centrifugal and proportioning pumps and fuel oil pump and heater sets.

Pump Specialists Since 1920

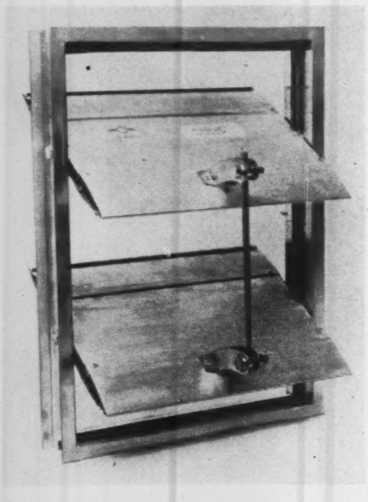
EQUIPMENT DEVELOPMENTS

Continued



Blue Print File . . .

. . . for filing larger prints in smaller areas. Unit 32 in. long, 36 in. deep, and 60 in. high. Direct clamp holders with "T" tops glide into, and out of channel tracts. Single insertions and withdrawals made without disturbing other plans. *Momar Industries, 4176 W. Montrose Ave., Chicago 31, Ill.*

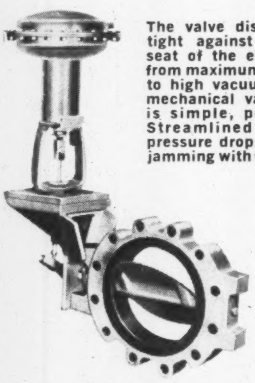


Damper . . .

. . . extruded aluminum unit with an air-foil double blade. Polyvinyl stripping where blade meets frame makes damper air-tight. Blade sizes, any length, 5 to 9 in. wide. Nylon bearings used throughout. When closed, double blade acts as insulator. *Arrow Louver & Damper Corp., 72 Berry St., Brooklyn 11, N.Y.*

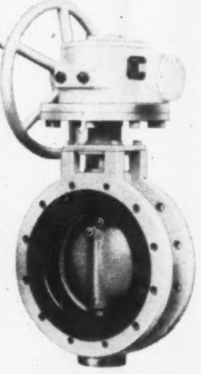
TIGHT CLOSURE is NO PROBLEM

***with* ROCKWELL BUTTERFLY VALVES**



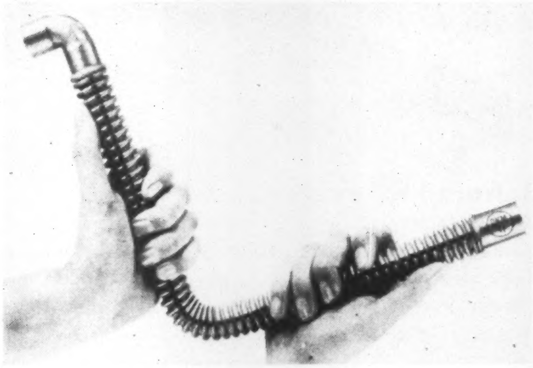
The valve disc seats drop-tight against the resilient seat of the elastomer liner from maximum line pressure to high vacuum. Manual or mechanical valve operation is simple, positive, fast. Streamlined design; low pressure drop; no fouling or jamming with foreign matter.

Wafer type butterfly valve with spool type rubber liner, available in "Keelok" snap-in, easily replaceable type or vulcanized to body. Shown with pneumatic operator. Bulletin 583.



Flanged type butterfly valve with spool type rubber liner and worm gear manual operator. Bulletin 582.

W. S. ROCKWELL CO.
2700 ELIOT ST., FAIRFIELD, CONN.

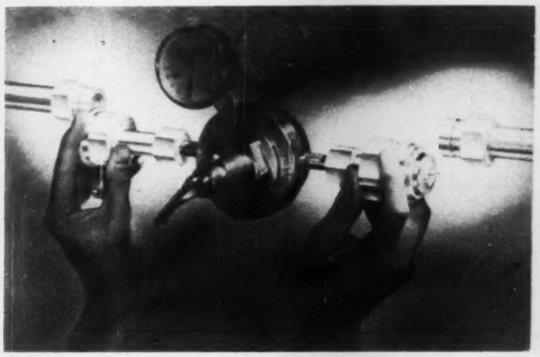


Connectors and Nipples . . .

. . . flexible hydronic units designed for steam and hot water heating systems. Made of copper, they can be formed by hand to connect radiators, pipes, expansion tanks, and similar products. Blue line running length of hose section identifies units as being designed for these systems. *Cobra Metal Hose, 5059 S. Kedzie Ave., Chicago 32, Ill.*

Welding Electrode . . .

. . . for use in all positions on low-alloy, high tensile steel applications, using a-c or d-c straight polarity. Meets AWS and ASTM specifications for E10013-G electrodes. Available in 12 in. lengths in 5/64 and 3/32 in. diameters, and in 14 in. lengths in 1/8 and 5/32 in. diameters. *Metal & Thermit Corp., General Offices, Rahway, N.J.*



Coupling . . .

. . . for addition or removal of relief, flow control or check valves, gages, pumps, or meters, in permanent pneumatic, hydraulic, or other fluid flow lines. Available in 1/2 and 1 in. ID sizes in choice of three metals: cadmium plated steel, anodized aluminum, or Type 316 stainless steel, passivated. *Snap-Tite, Inc., 201 Titusville Rd., Union City, Pa.*

NEW . . . . Now ! !

MAC FAN

(MIXED-AXIAL-CENTRIFUGAL)

New mixed flow fan especially designed for either centrifugal or axial type fan applications in heating, ventilating and air conditioning.

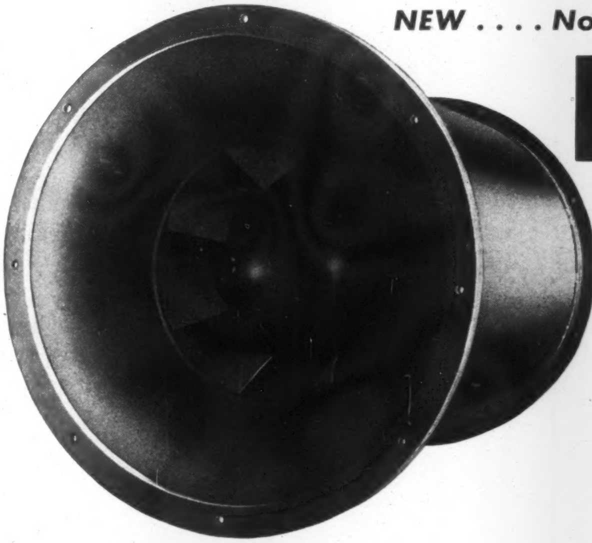
True non-overloading horsepower curve at comparable speeds and sound levels of the centrifugal, featuring a constantly rising, non-peaking pressure curve. Comparable to the axial with integral, economical space saving compactness.

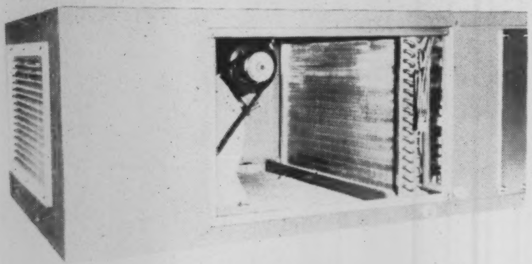
Write today for free Technical Data Bulletin.

Selected Territories Available
For Qualified Sales Representatives.

Air Motion Research Division
Missile Dynamics Corporation

A subsidiary of Lancer Industries, Inc.
10890 Stanford Avenue (Los Angeles County) Lynwood, California



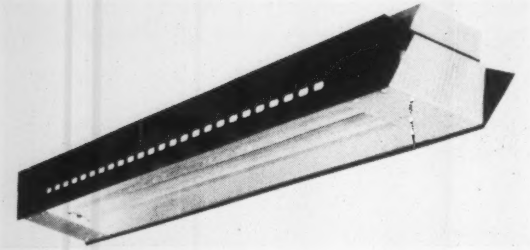


Blower-Coil Units . . .

. . .horizontal, packaged, 2, 3, 4, and 5 ton models. Can be used for add-on cooling in existing warm air systems, or for other cooling operations. Additional room in cabinet for hot water or steam coil for heating. *United Electric Co., P. O. Box* 119, 501 *Galveston St., Wichita Falls, Tex.*

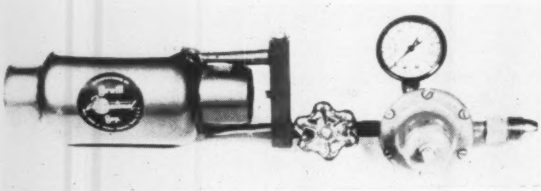
Fused Capacitors . . .

. . .to open air conditioning compressor motor circuit in event of shortened running duty capacitor. Available in range of microfarad ratings at both 370 and 440 v a-c. *General Electric Co., Schenectady* 5, *N.Y.*



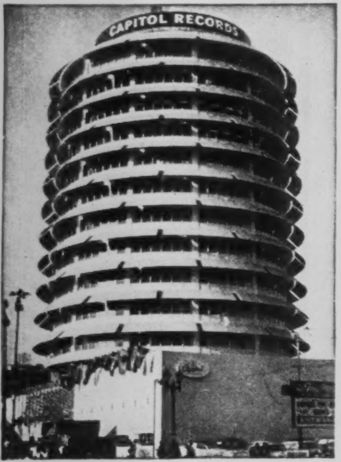
Infrared Heaters . . .

. . .for heating directly from source to object without heating intervening air. Designed for overhead mounting, units convert as much as 86 percent of electrical energy into radiant output. Bulletin sent on request. *Fostoria Corp.,* 1200 *N. Main St., Fostoria, O.*



Portable Burners . . .

. . .two LP-gas units: model "CW-2" has capacity of 600,000 Btu per hr; model "CW-3" has 1,000,000 Btu per hr capacity. *Corwill International Corp., P.O. Box* 1030, *Cedar Rapids, Ia.*



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

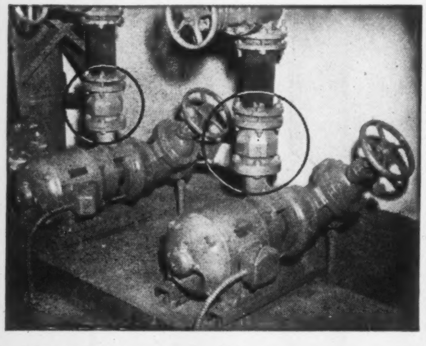
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW. FACTORY MUTUAL LABORATORIES APPROVED.

SIZES 1" THROUGH 24"

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE

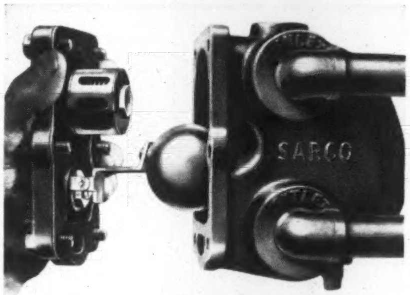


Write for literature • Agents in Principal Cities

MILLER VALVE CO., INC.

Pittsburgh 30, Pa. **Plant—1620 Pennsylvania Ave.**

SARCO



The Sarco Float Thermostatic Steam Trap cannot air bind, because its high-capacity air vent automatically discharges all air as rapidly as it reaches the trap. Requires no adjustment when pressures change. Available for steam pressures to 200 psi.

FOR CONTINUOUS DRAINING AND VENTING ...SARCO FT STEAM TRAP

When you install the Sarco Float-Thermostatic Steam Trap you can depend upon it to discharge condensate continuously, at steam temperature, completely and without shock. Its thermostatic air vent removes immediately and automatically all air and incondensable gases reaching the trap. The FT never interferes with temperature regulation—because it never causes pressure fluctuations in the space being drained.

That's why the Sarco Type FT meets the special trapping requirements of heating coils—as well as steam main drips, unit heaters, heat exchangers, and other applications demanding accurate temperature control.

WRITE FOR SARCO FT BULLETIN

Remember that Sarco can give you *impartial* advice on steam trapping because *only* Sarco makes all 5 types: Float-Thermostatic...Thermostatic . . . Liquid Expansion . . . Thermo-Dynamic . . . Bucket.

2170

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA

RECENT TRADE LITERATURE . . .

▶ *BALANCING VALVE*—described in bulletin No. "204." Unit is a dual-purpose hot water balancing and shut-off valve. Can be adapted to almost any heating and cooling water application. *American Air Filter Co., Inc., Dept. PD,* 215 *Central Ave., Louisville* 8, *Ky.*

▶ *BALL BEARINGS*—literature features technical and engineering data, specifications, diagrams, illustrations, and typical applications of product. Units have permanent seal, pre-lubrication, self-aligning, and zone hardening features. Catalog "454." *Sealmaster Bearing Div., Stephens-Adamson Mfg. Co., Ridgeway Ave., Aurora, Ill.*

▶ *BLOWERS AND PARTS*—eight page catalog describes belt-drive blowers, direct-drive blowers, selection of cartridge bearings, flange bearings, pillow blocks, bearing brackets, shafting thrust collars, and parts for all makes of blowers. Split phase and shaded-pole motors, humidifiers, blower packages, permanent filters, humidifier plates and jet room balancer. *Viking Air Products,* 5601 *Walworth Ave., Cleveland* 2, *O.*

▶ *CENTRIFUGAL FAN*—with straight line air flow discussed in a 16 page catalog. Unit available in six sizes based on AMCA centrifugal wheel standards. Volumes range from 4600 to 48,000 cfm in pressure classes I, II, and III up through 9 in. water gage static. Catalog "1125." *Westinghouse Electric Corp., Sturtevant Div., Hyde Park, Boston* 36, *Mass.*

▶ *CONVERSION FACTORS*—common conversions such as inches to centimeters and watts to horsepower, plus harder to locate conversions such as microns to meters given on a wall chart. *Precision Equipment Co.,* 4411*E. Ravenswood Ave., Chicago* 40, *Ill.*

Install Insulation with
TUFF-BOND
Super-Strength Adhesives

TUFF-BOND #6
. . . non-flammable fire-retardant adhesive for installing insulation

TUFF-BOND #7
. . . fire-retardant adhesive for installing insulation

TUFF-BOND M-102-H
. . . duct liner adhesive

TUFF-BOND 21-C
. . . clear lap sealer and lap adhesive

TUFF-BOND 21-W
. . . white lap sealer and lap adhesive

TUFF-BOND #500
. . . exceptionally high-strength chemical-set adhesive. Wide thermal range −100° F. to 350° F.

TUFF-BOND #1000
. . . high heat resistance for bedding and installing high temperature insulation

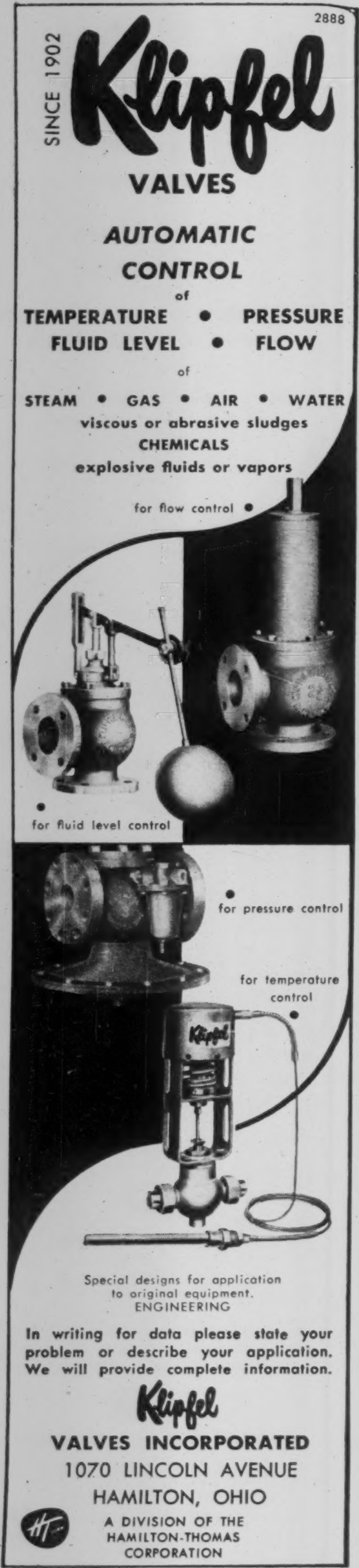
TUFF-BOND #12
. . . high pressure duct sealer

TUFF-BOND QUIK SET
. . . neoprene-base, fast-setting adhesive. Recommended for installing metal and nylon hangers to smooth surfaces.

TUFF-BOND GENERAL PURPOSE IMPROVED
. . . all-around adhesive for installing insulation, insulation hangers, etc.

Ask for literature and prices.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 26, ILLINOIS


2888

SINCE 1902 **Klipfel** VALVES

AUTOMATIC CONTROL
of
TEMPERATURE • PRESSURE
FLUID LEVEL • FLOW
of
STEAM • GAS • AIR • WATER
viscous or abrasive sludges
CHEMICALS
explosive fluids or vapors

for flow control •
for fluid level control •
for pressure control •
for temperature control •

Special designs for application
to original equipment.
ENGINEERING

In writing for data please state your problem or describe your application. We will provide complete information.

Klipfel
VALVES INCORPORATED
1070 LINCOLN AVENUE
HAMILTON, OHIO
A DIVISION OF THE
HAMILTON-THOMAS
CORPORATION

RECENT TRADE LITERATURE

Continued

▶ *CORROSION CONTROL*—literature explains applications of anti-resin deposit and anti-corrosive agent. Sprayable, non-lacquer type is for service on motors, boiler water treatment equipment, air conditioning equipment, and other applications. *Textile Adjuncts Corp., Marine and Industrial Div., 4907 Farragut Rd., Brooklyn 3, N.Y.*

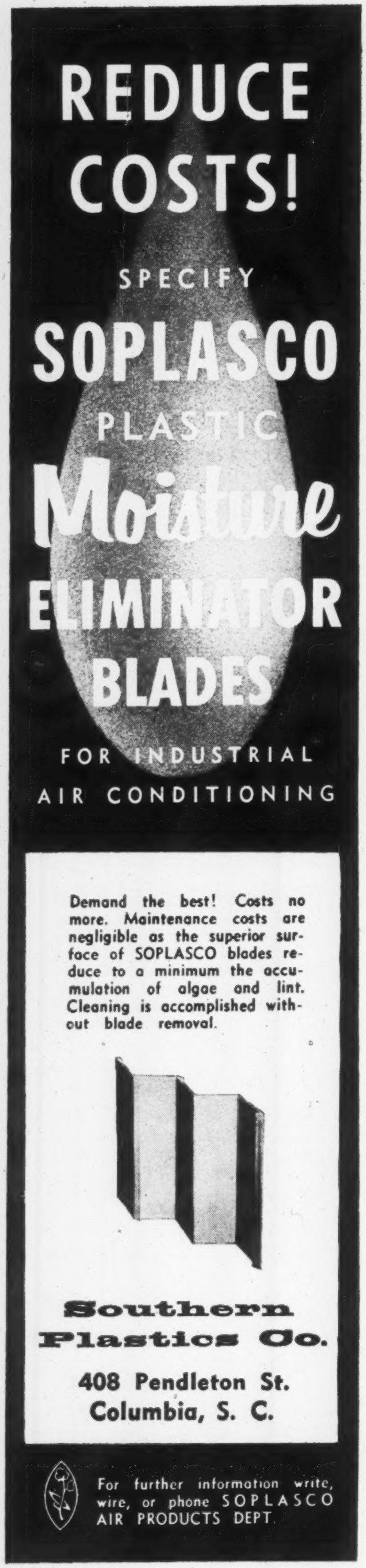
▶ *CLAY PIPE*—40 page catalog lists sizes and dimensions of standard strength, extra strength, perforated, and double-length vitrified clay pipe and allied clay products. Form "E-360-53." *Evans Pipe Co., Uhrichsville, O.*

▶ *DEODORIZERS*—series of bulletins outlining commercial and institutional applications of electrostatic deodorizers. Units burn out odors, fumes, and smoke without use of chemicals, filters, lights, or ozone. Available in several models to fit individual applications. *Morris Deodorizers, Inc., Dept. "B-2,"* 2819 *N. Broadway, Knoxville* 17, *Tenn.*

▶ *DIAPHRAGM CONTROL VALVES*—24 page bulletin "800" discusses the design, operation, and typical applications of product. *Warren Engineering Co., Div. of Warren Automatic Controls Corp., Main St., Broadway, N.J.*

▶ *DUST CONTROL EQUIPMENT*—bulletin describes complete line. Four main types of dust control are discussed: dry centrifugals, wet collectors, fabric collectors, and electrostatic precipitators. Bulletin No. 271, "AAF Equipment for the Control of Dust." *American Air Filter Co., Inc.,* 215 *Central Ave., Louisville 8, Ky.*

▶ *ELECTRIC AIRDUCT HEATERS*—for central heating, reheat after dehumidification, auxiliary heating, zone control, old and new duct systems, and similar applications. Speci-


REDUCE COSTS!

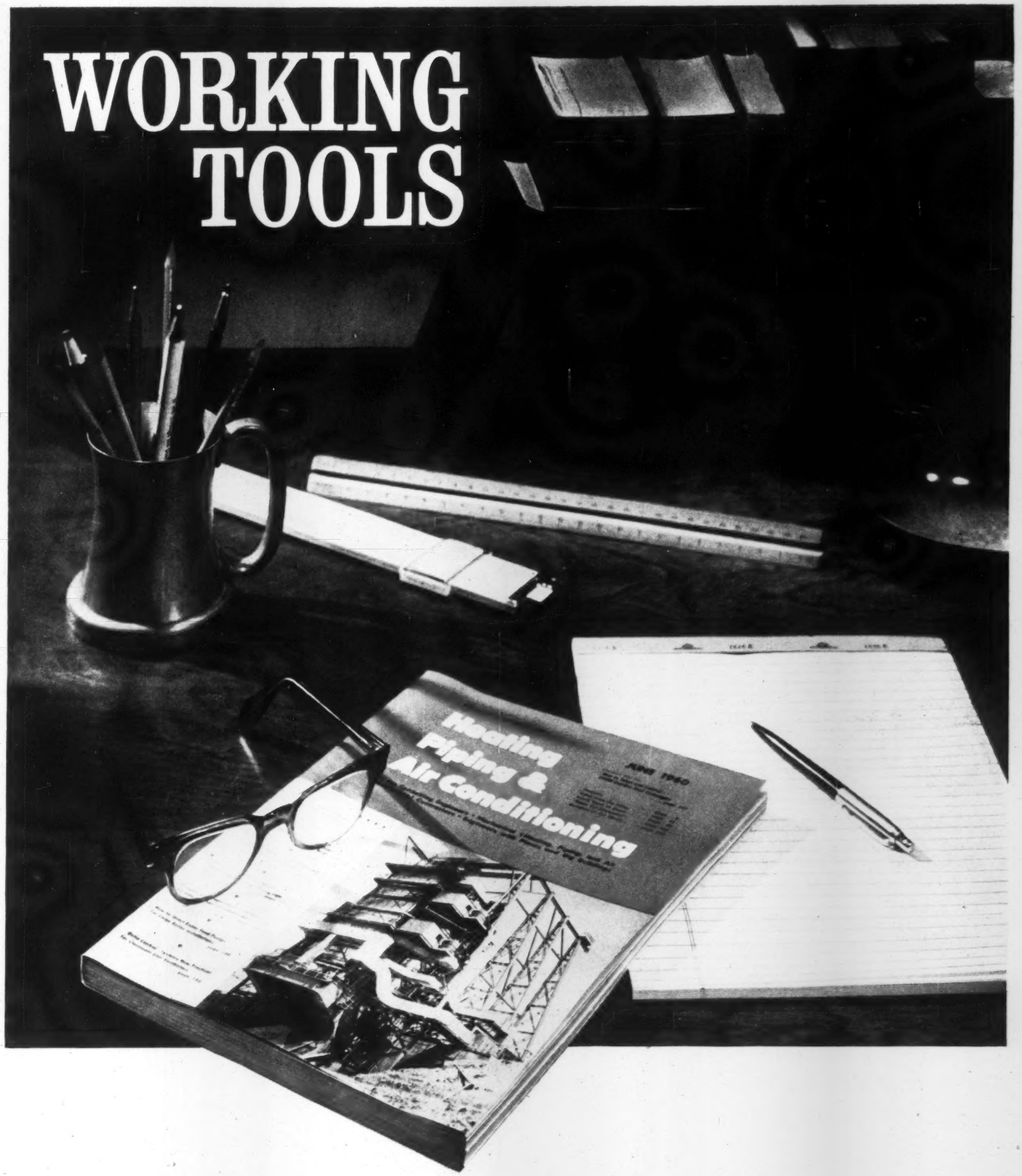
SPECIFY
SOPLASCO
PLASTIC
Moisture
ELIMINATOR BLADES
FOR INDUSTRIAL AIR CONDITIONING

Demand the best! Costs no more. Maintenance costs are negligible as the superior surface of SOPLASCO blades reduce to a minimum the accumulation of algae and lint. Cleaning is accomplished without blade removal.

Southern Plastics Co.
408 Pendleton St.
Columbia, S. C.

For further information write, wire, or phone SOPLASCO AIR PRODUCTS DEPT.

WORKING TOOLS



Pictured above are some familiar working tools of heating, air conditioning, piping and ventilation men.

We're proud of the place *Heating, Piping & Air Conditioning* occupies on the desks of such men. For more than 18,000 readers it's a time-saving tool as familiar and reliable as a slide rule.

There's probably a copy on *your* desk every month. But if there's not, you can have one there at very modest cost. Just drop us a note or a card to the address below.

Heating, Piping & Air Conditioning
6 North Michigan Avenue Chicago 2, Illinois

Small, Lightweight

MERCOID

PRESSURE CONTROL

for

Instrument Air

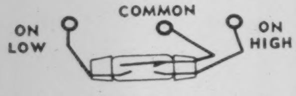
Exclusive Features

- EXTERNAL ADJUSTMENT
- VISIBLE CALIBRATED DIAL
- VISIBLE SWITCH POSITION
- FOR PANEL OR PIPE MOUNTING
- SEALED MERCURY CONTACT

MERCOID CONTROL
THE MERCOID CORPORATION
CHICAGO 41, ILLINOIS U.S.A.

TYPE AP-153

ADJUSTABLE OPERATING RANGE	SWITCH DIFFERENTIAL With Pointer Set At	
	LOW	HIGH
1 to 20 psig.	0.3	0.5
1 to 30 psig.	0.4	0.75



Provides any of following operations:

1. *Single Pole—Cut-in high (close on rise)*
2. *Single Pole—Cut-in low (open on rise)*
3. *Single Pole—Double Throw*

OTHER TYPES AVAILABLE

CASE: NEMA 1—Heavy gauge steel, cadmium plated. Steel cover (with glass front).

WRITE FOR BULLETIN 02

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.

RECENT TRADE LITERATURE

Continued

fication data, drawings, illustrations, and operating charts provided in a six page booklet "F40100-1." *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*

▶ *ELECTRIC BLAST COIL HEATERS*—for duct installation as source of prime heat, supplemental heat with heat pumps, or auxiliary heat for zone control. Units are UL listed and can be customed designed. Catalog "E-97U." *Industrial Engineering & Equipment Co., 24 Hanley Industrial Court, St. Louis (Brentwood) 17, Mo.*

▶ *FASTENING TOOLS*—13 page reference manual "H-46," with charts, graphs, and illustrations, describes firm's system for making industrial fastenings. Brochure illustrates both hammer-actuated and power-assisted fastening tools, as well as fasteners, booster caps, and accessories. *Hilti, 73 Southfield Ave., Stamford, Conn.*

▶ *FLEXIBLE SHAFTS*—simplified approach to selection of flexible shafting given in fourth edition of handbook. Describes advantages of flexible shafts, their function, successful applications, fundamental information on standard power drive and remote control shafts, uses of adapters and other accessories. Includes section of tables and statistics. *S. S. White Industrial Div., Dept. P., 10 E. 40th St., New York 16, N.Y.*

▶ *FLOW CONTROLS*—catalog contains a small illustration for each size and type of device. Prepared for distribution by firm's wholesalers. *Henry Valve Co., 3215 North Ave., Melrose Park, Ill.*

▶ *FLOW METER*—for measuring low flow rates of liquids or gases, described and illustrated in two page

Babbitt

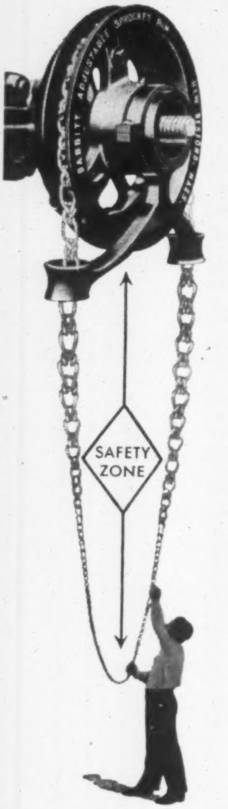
Adjustable

SPROCKET RIM

with Chain Guide

Changes that Danger Zone to a

SAFETY ZONE



. . . saves you money

ON EVERY VALVE

Every minute saved is money in your pocket. Cut out the waste of time, labor, floor space due to hard-to-reach valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides for day to day economy.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman or contact us direct

108-9

Babbitt

STEAM SPECIALTY CO.

8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

The A. B. C. Symbol...

AUDITED PAID CIRCULATION

ABC

The right to purchase or refrain from purchasing this publication gives you, the reader, and no one else the power to pass judgment on whether it shall continue to survive. This symbol represents the standards by which your voluntary response is measured. It testifies to the advertising value of this publication. It also serves as a constant guide to our readers' opinion.

This symbol represents our membership in the Audit Bureau of Circulations, your assurance that our circulation facts are verified by independent audit, measured by recognized standards, and reported in standardized reports. These audited facts, available without obligation to interested persons, provide a factual basis for advertising rates, evidence of subscriber interest, facts on market coverage, and facts for appraising our circulation quality and editorial vitality.

Heating, Piping & Air Conditioning

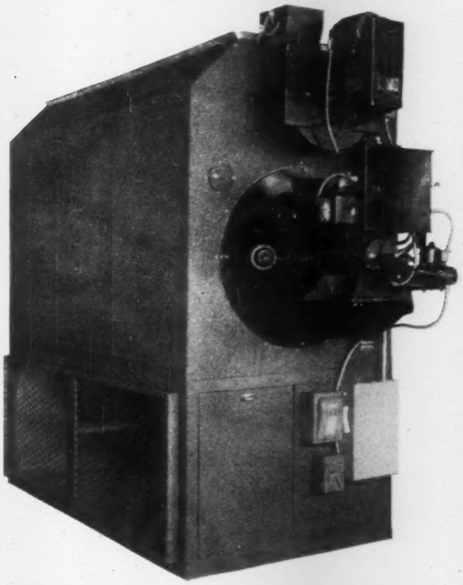
Hallmark of Circulation Value

AUDITED PAID ABC CIRCULATION

Johnson

MODEL FA

Packaged Heating Units



Fyre-Tube HEATERS MODEL FA Sizes to 4,000,000 Btu/hr output

DIRECT FIRED with OIL, GAS, or COMBINATION BURNER.
FLOOR or SUSPENDED MODELS for use with or without ductwork

HEATING ▶ VENTILATING
▶ AIR CONDITIONING
▶ DRYING ▶ MAKE-UP AIR

Aire-Tube HEATERS
MODEL JAS Suspended 17 sizes to 1,000,000 Btu/hr output capacity
MODEL JA FLOOR Type 24 sizes to 5,000,000 Btu/hr output capacity

SOME TERRITORIES STILL AVAILABLE TO EXPERIENCED SALES REPRESENTATIVES

Please mail coupon now!

PLEASE SEND FULL INFORMATION ON JOHNSON HEATER CHECKED

☐ FA ☐ JAS ☐ JA ☐ COMPLETE LINE

Type of Application ....

Name .... Position ....

Firm Name ....

City .... Zone .... State ....

JOHNSON HEATER CORP.

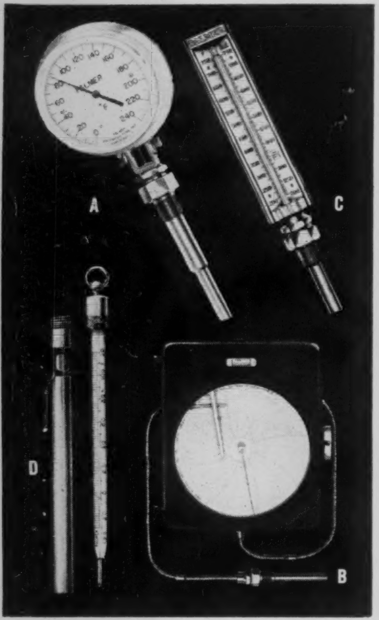
1 WINNISIMMET ST. CHELSEA 50, MASS.

Available in Canada from: CANADIAN WESTINGHOUSE CO. Ltd.
STURTEVANT DIVISION, GALT, ONTARIO

A GREAT NAME IN THERMOMETERS

PALMER

Mercury Actuated Temperature Indicating Instruments



A—4½" DIAL THERMOMETERS: Made in 3 types to suit any requirements. Rigid stem, wall or flush mounted, 11 inches of scale reading. Interchangeable with standard industrial separable sockets. Stem can be placed at any angle and case can be rotated to any readable position.

B—RECORDING THERMOMETERS: Twelve inch die-cast aluminum case with black finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges: −40 +950° F or Equivalent in °C.

C—INDUSTRIAL THERMOMETERS: Red-Reading Mercury—Extruded brass case—chrome finish. Ranges: −40 +950° or Equivalent in °C.

D—RED-READING MERCURY LABORATORY THERMOMETERS: Thoroughly annealed for permanent accuracy. Complete line A.S.T.M. and fractional division types.

FOR COMPLETE INFORMATION WRITE FOR CATALOG

PALMER

PALMER THERMOMETERS, INC.
Cincinnati 12, Ohio • MElrose 1 1500

RECENT TRADE LITERATURE
Continued

bulletin. Dimensional drawings of both 1½ and 4 in. scale models, materials of construction, method of mounting, operational limits, capacities, and optional accessories also given. *Fisher & Porter Co., 628 Jacksonville Rd., Warminster, Pa.*

▶ *FLOW METER*—uses vortex-velocity principle for measuring liquids and gases. Measures volume rate at line conditions and can be combined with a densitometer or other instruments to measure mass flow. Described in catalog "C295-1" and instrumentation data sheet "10.3-9." *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.*

▶ *GAGES, CONTROLS, THERMOMETERS, CONTROLS*—Six page bulletin describes line of bourdon-tube type pressure gages; dial and glass tube, panel type, and multi-angle thermometers; indicating controllers; valve positioner and pilot options; recorders; chemical attachments; and accessories. Bulletin "30-20." *United States Gauge, Div. of American Machine and Metals, Inc., Sellersville, Pa.*

▶ *HEAT COMPUTER*—for figuring heat loss and cost of electrically heated buildings. Booklet shows wattage loss for six significant areas: windows, doors, walls, ceilings, floors, and by infiltration. Also contains charts showing outside design temperatures throughout the country and an annual degree-day map. *Electric Heat Div., Arvin Industries, Inc., Columbus, Ind.*

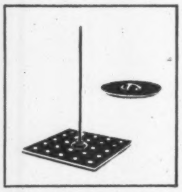
▶ *HEAT EXCHANGERS*—4 in. multi-tube, double pipe units described in bulletin "111." Explains design features, shows applications, and gives cutaway drawings. *Brown Fintube Co., 300 Huron St., Elyria, O.*

INSULATION INSTALLED FAST

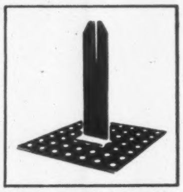
WITH

MIRACLE SURFACE ANCHORS

Use Miracle Surface Anchors, bonded with Miracle Anchor Adhesives, to provide firm support for block, board, or blanket type insulation. Eliminates drilling and welding. You save man hours, cut costs way down.



Use Spindle Anchors for bonding fibrous glass batts, mineral wool to ducts, walls, ceilings. Lock washer holds insulation firmly in place.



Use Pronged Anchors for bonding block insulation such as cellular glass. Pronged Anchors are set between rows of blocks and then prongs are bent over.

FREE

Valuable, informative engineers and architects bulletins giving details and complete specification data. Yours on request.

MIRACLE SURFACE ANCHORS
are manufactured by
DEVICES • Division of
MIRACLE ADHESIVES CORP.
250 Pettit Avenue
Bellmore, Long Island, New York

RECENT TRADE LITERATURE

Continued

▶ *HEATING CONTROLS*—six page catalog contains identifying illustrations, descriptions, and recommended applications. Covers line of thermostats, transformers, zone relays, gas valves, vent valves, and limit, immersion, clamp-on temperature, changeover, and stack controls. Catalog "500 C." *Detroit Controls Div., American-Standard, 5900 Trumbull Ave., Detroit 8, Mich.*

▶ *HEAT TRANSFER EQUIPMENT*—brochure summarizes complete line of products such as double pipe heat exchangers, indirect fired heaters, tank heaters, tank suction and line heaters, process heaters and coolers, gas cooling and heating equipment, and special custom built equipment. Bulletin "800." *The Brown Fintube Co., 300 Huron St., Elyria, O.*

▶ *HEAT TRANSFER EQUIPMENT*—four page bulletin describes line of storage water heaters, instantaneous heaters, hot water converters, welded steel heat exchangers, and other products. Bulletin "51." *Niagara Weldments Inc., 55 Portage Rd., Niagara Falls, N.Y.*

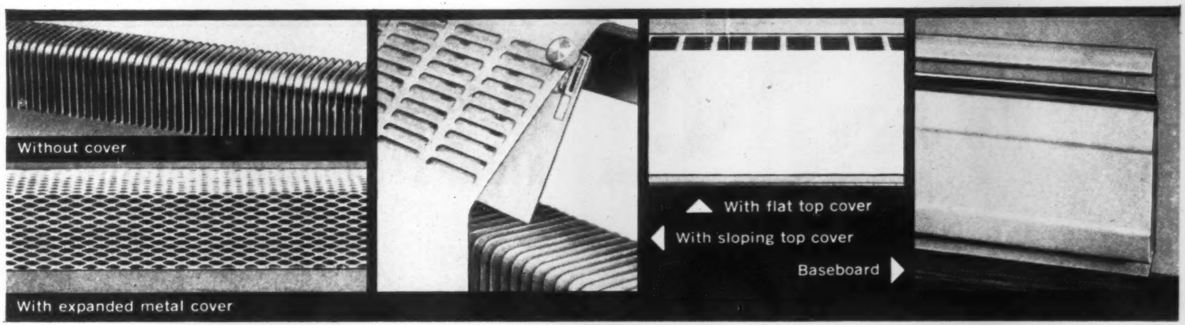
▶ *HEAT TRANSFER EQUIPMENT*—32 page catalog covers radiators, heat exchangers, supercharger air coolers, industrial and oil field equipment, and heating and air conditioning products. Nuclear heat transfer applications with stress on technical research developments to meet requirements of the future, also given. *Young Radiator Co., 709 S. Marquette St., Racine, Wis.*

▶ *HYDRONIC HEATING*—100 page manual for commercial application of hydronic heating. Has section devoted to basic principles as well as sections on boiler sizing, modern system design, and boiler replacement piping. Manual No. "PB-125." *Permaglas Div., A. O. Smith Corp., Kankakee, Ill.*

▶ *INFRARED HEATERS*—four page bulletin contains illustrations, application information, features, and specification data. Line voltage thermostat controls and input controllers also featured. Bulletin "F70-100-2." *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*

▶ *MAGNETIC STARTERS* — with all components removable from front. Plug in pushbutton or selector switch units can be added in field. Thermal overload relays have trip indicator, are non-adjustable, and tamper proof. Dual voltage 110/220 or 220/440 dual cycle 50-60 coils standard. *Furnas Electric Co., 1041 McKee St., Batavia, Ill.*

▶ *MAINTENANCE CONTROL BOARD*—bulletin describes visual controls using magnetic devices on a standard 24 × 36 in. board. Graphic



32 different copper and steel heater elements to choose from in the complete SARCOfIN line.

Choose the finned tube radiation that best meets your requirements—from the complete Sarcofin line. Choice of 32 different heating elements. Eight types of enclosures: flat-top, expanded metal, sloping top, modified flat top, sill-type and three baseboard cover types.

And for old or new homes, remember the variety, flexibility, and easy installation of Sarco-Pak baseboard radiation.

All ratings are approved under the I-B-R code. For your extra convenience, standard length "packages" are now available. Superb appearance matches high Sarco quality.

You always get the advantage of single-source responsibility, when you specify Sarco-Sarcotherm for all your finned-tube radiation, heating specialties, pumps, regulators, and weather-compensated control systems. Write for your copies of latest bulletins on Finned-Tube Commercial Radiation and Baseboard Radiation.

2363

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

RECENT TRADE LITERATURE

Continued

scheduling of personnel, activity, and equipment. Available with a number of visual elements such as arrows, bars, and card holders. Special sizes of board can be built. *Methods Research Corp., 105 Willow Ave., Staten Island 5, N.Y.*

▶ *NOISE CONTROL* — eight page booklet gives engineering specifications and performance data for 27 types of products for the control and measurement of machinery vibration, shock, and noise. Installation photos, equipment selector chart, recommended and alternate methods of isolation included in booklet "K4G." *The Korfund Co., Inc., OIF Cantiague Rd., Westbury L.I., N.Y.*

▶ *PARTICLE SIZING*—explained in Manual 6. Describes methods of determining particle size by using optical or electron microscopes. Tells how to use oil immersion techniques for particle mounting. Proper particle measurement methods also discussed and equation for converting particle size by count to particle size by weight is given. *Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.*

▶ *PIPE AND BLOCK INSULATION*—for use in power, chemical, petroleum, petrochemical, and manufacturing industries. Calcium silicate insulation for temperatures up to 1350 F. Six page brochure lists heat transmission data, physical and thermal characteristics, standard sizes, and recommended thicknesses. Form "6472." *Philip Carey Mfg. Co., 320 S. Wayne Ave., Cincinnati 15, O.*

▶ *PIPE FITTERS MANUAL* — Comprehensive 72 page handbook covers subjects such as characteristics of welded and threaded piping; basic mathematical formulas and conversion factors; dimensions of welding fittings and flanges; commercial pipe sizes; electrode data; and practical tips on welding, properties of pipe, metals, and fluids. *Tube Turns Div. of Chemetron Corp., 224 E. Broadway, Louisville 1, Ky.*

▶ *PIPE FOR FIRE PROTECTION* —eight page brochure describes and illustrates advantages of asbestos-cement pipe for industrial plant fire protection systems. A typical arrangement from tank or well to connections to building supply and hydrants, including correct location of fittings and outlets is given. Bulletin "TR-253A." *Johns-Mansville Corp., 22 E. 40th St., New York 16, N.Y.*

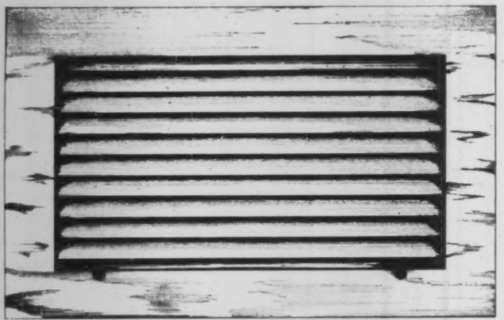
▶ *PIPELINE FILTER ASSEMBLIES* — over 225 items of 20 basic types of standard woven wire mesh element-in-line filters described in 22 page bulletin. Working pressure, temperature ranges, port sizes, and other factors listed for each type shown. *Aircraft Porous Media, Inc., 30 Sea Cliff Ave., Glen Cove, N.Y.*

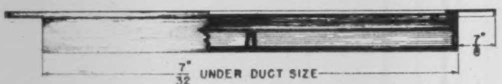
NEW from A-J!

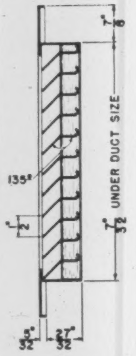
A-J No. 22 Series

Rain and Snow-Proof

EXTERIOR STATIONARY LOUVER







Here's ventilation or fresh air intake **plus** weather protection conveniently combined in a single unit! Completely bird-proof. This stationary exterior louver has closely spaced horizontal bars on 1/2" centers. The louver unit is 13/16" in depth, and manufactured 7/32" under listed size. All-steel construction throughout on the No. 22 style.

The No. A-22 has an extruded aluminum frame end bars of Armco Aluminized steel which gives an unbeatable combination of strength and durability for long-time exterior application.

Aluminum bug screen available at additional cost.

FREE catalog contains complete identification and selection.

Write for your copy.

A-J MANUFACTURING CO.

Dept. H-11 3601 E. 18th St.
Kansas City 27, Mo.

▶ *PLASTIC VALVES AND FITTINGS* — 16 page folder describes units available in corrosion-resistant polyvinyl chloride. Application table rates PVC's effectiveness on over 300 fluids. Illustrated descriptions and dimensions of all valves (Y-globe, check, bleeder, and diaphragm); strainers, unions, fittings, and expansion joints. *Walworth Co., 750 Third Ave., New York 17, N. Y.*

▶ *PNEUMATIC CONTROLLERS* — for controlling pressures up to 10,000 psi and temperatures from -125 F to 1000 F. Catalog "J-C" describes features and accessories, gives dimensions, specifications, and engineering information. Data on when to use a controller also given. *OPW-Jordon, 6013 Wiehe Rd., Cincinnati 13, O.*

▶ *PORTABLE SPACE HEATERS* — catalog gives specifications on five sizes ranging from 100,000 to 1,000,000 Btu per hr. Information on selecting the correct size heater also given. Catalog "6016." *Stow Mfg. Co., 143 State St., Binghamton, N.Y.*

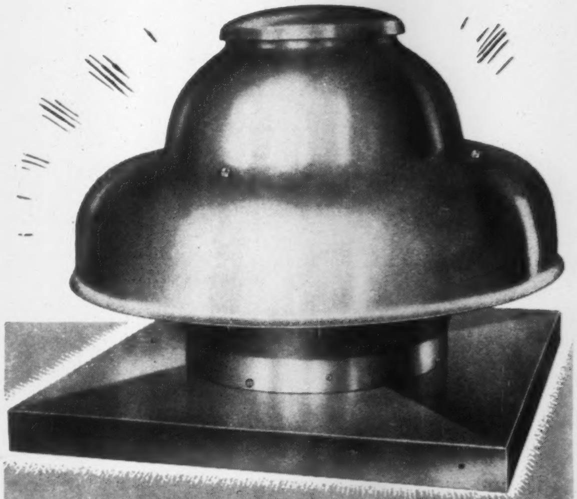
▶ *PROBES, LEADS, SWITCH BOXES* — catalog brochure describes series of interchangeable probes, extension leads, and multiple channel switch boxes. Accessories allow multiple readings from a simple indicating circuit. *Yellow Springs Instrument Co., Inc., Yellow Springs, O.*

▶ *PUMPS* — for control and regulation of huge volumes of water. Two types: an axial flow propeller pump and a mixed flow pump. Both available in single or multi-stage designs, and capable of handling up to 220,000 gpm, with lifts ranging from 2 to 60 ft. Bulletin "B-148." *Peerless Pump, Hydrodynamics Div., Food Machinery and Chemical Corp., 301 W. Avenue 26, Los Angeles 31, Calif.*

▶ *REDUCING AND RELIEF VALVE* — used in water, oil, air, or gas service to initial pressures of 4000 psi. Available in ½ and ¾ in. sizes. Catalog shows single-seated, spring-loaded, diaphragm actuated valve, designated "3851, type F," with adjustable pressure ranges of 0-1000, 0-2000, and 0-3500 psi. *Atlas Valve Co., 280 South St., Newark 5, N.J.*

Aladdin
AIR HANDLING EQUIPMENT

Type "S" *Centrifugal*
ROOF VENTILATORS



- CERTIFIED RATINGS
- ALUMINUM HOUSED
- ATTRACTIVE DESIGN
- WEATHERPROOF
- QUIET OPERATION

CERTIFIED RATINGS
AUTHORIZED BY
AMCA

ALADDIN Type "S" Roof Ventilators feature an attractive Spun Aluminum Housing of low contour. Designed especially for those installations which require a small powered exhaust unit. The Type "S" Roof Ventilator is ideally suited for schools, hospitals and similar type buildings.

Seldom requiring maintenance, these units are furnished with unusually quiet, fan cooled motors with outstanding lubricating systems, assuring long, continuous service under severe conditions of dust and dirt.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

RECENT TRADE LITERATURE

Continued

▶ *REGISTERS, DIFFUSERS, GRILLES* — 20 page catalog illustrates complete line. Registers and grilles are made entirely of extruded aluminum. Catalog "60." *The A & A Register Co.*, 8327 *Clinton Rd., Cleveland* 9, *O.*

▶ *RESISTANCE THERMOMETERS* — for measuring temperatures of gases, liquids, solids, pastes, rotating surfaces, or surfaces with irregular contours, from 30 F to 350 F. Thermo-anemometer gives measurements of velocity and temperature of air streams in open areas or inside ducts. *Gelman Instrument Co.*, 106 *N. Main St., Chelsea, Mich.*

▶ *STEAM CONVERTERS* — for heating radiation water with steam. Catalog includes specifications, operation data, leaving water temperature tables from 170 F through 230 F, piping installation diagram, and water side pressure drop curves. File No. "1460." *Dunham-Bush, Inc.*, 179 *South St., West Hartford* 10, *Conn.*

▶ *STEEL PIPE* — folder contains basic information on pipe specifications, how pipe size is determined, what the pipe making processes are, and other pertinent facts. Gives chart and illustrations of ASA pipe schedule dimensions. Entitled "What to Know about Pipe." *Youngstown Sheet and Tube Co., P. O. Box* 900, *Youngstown* 1, *O.*

▶ *STORAGE TANKS, HEATING ELEMENTS* — hot water tank capacities to 6570 gal; heating elements to 33,000 gpm. Element capacities calculated for 140 F rise utilizing 1¼ or ¾ in. OD tubes. Dimensions, pressures, weights, and prices in catalog "BH-2N." *The Sims Co., P. O. Box* 1096, *Erie, Pa.*

▶ *TEST INSTRUMENTS* — for automatic measurement of sound, vibration, and strain discussed in 24 page catalog. *B & K Instruments, Inc.*, 3044 *W.* 106*th St., Cleveland* 11, *O.*

▶ *UNIT HEATERS* — for use in the metalworking industry. Bulletin "MI-60, Wing Heaters For The Metals Industry," covers solution of problems of proper warm air distribution in areas of machinery, replacement of air exhausted by fume removal systems, and tempering of cold air inrush through shipping doors. *L. J. Wing Mfg. Co.*, 140 *Vreeland Mills Rd., Linden, N.J.*

▶ *VALVES* — 20 page catalog contains competitive cross reference charts and weight tables for comparative purposes; data covering pressure and temperature controls, solenoid valves and strainers; plus ordering information. "D. T. Williams Catalog

PACKLESS VIBRATION ABSORBERS

Engineered and constructed for complete and lasting absorption of vibration and noise.

Manufactured of Seamless Flexible Bronze Hose — Tin Bronze Wire Braid Covering — Sizes 3/16 thru 6".

—Made to exceed standards established by Original Equipment Manufacturers.—

—Listed by Underwriters' Laboratories, Inc.—

—Available from Leading Wholesalers—

Complete stocks maintained at Factory and Warehouses located at:

Mount Vernon, N. Y.
Atlanta, Georgia
Fort Worth, Texas
Los Angeles, Calif.
Minneapolis, Minn.
Chicago, Illinois

Quality Products and Dependable Service for over 25 years

BUY QUALITY BUY
PM HOSE
PACKLESS METAL HOSE
PIONEERS IN METAL HOSE FOR OVER A QUARTER OF A CENTURY

Request Bulletin VA for Complete Information

PACKLESS METAL HOSE, INC.

730-12 S. COLUMBUS AVENUE MT. VERNON, N. Y.

800-A." *Detroit Controls Div., American-Standard, 5900 Trumbull Ave., Detroit 8, Mich.*

▶ *VIBRATION ISOLATOR* — to protect electronic equipment from shock, vibration, and steady-state accelerations encountered in high-performance aircraft and missiles, described in a two-page bulletin. Frequencies are 15 to 30 cycles per sec. Temperature range is from −85 F to 250 F with negligible performance change. *Barry Controls Inc., 700 Pleasant St., Watertown 72, Mass.*

▶ *WARM AIR HEATERS* — eight page booklet illustrates and describes product line. Specifications, plan and dimension drawings, and photographs are given for both gas and oil-fired models. Bulletin "13-11." *Wanson Corp., Charles and Juniata Sts., Lewistown, Pa.*

▶ *WATER HEATERS* — eight page catalog describes steam injection units for water heating systems. Capacities range from 500 to 50,000 gph. Diagrams show how units are used for direct, circulator, accumulator, and booster installations. *Pick Mfg. Co., West Bend, Wis.*

▶ *WATER CONDITIONING* — data sheet discusses causes and cures of corrosion in boiler return lines. Publication entitled "Return Line Corrosion Need Not Be a Problem." *Betz Laboratories, Inc., Gillingham and Worth Sts., Philadelphia 24, Pa.*

▶ *WATER TREATMENT* — four page bulletin "CS-107" illustrates chemical feed system which controls amount of reagent chemicals to be added to boiler feed water. Typical installation diagram, piping layout, specifications, dimensions, and fittings are also given. Bulletin "CS-110" describes advantage of using briquets of compressed chemicals which dissolve at a uniform rate, releasing proper amount of chemical into system. *Ionac Chemical Co., Div. of Pfaudler Permutit Inc., Birmingham, N.J.*

▶ *WELDING* — 56 page welding, brazing and soldering alloy and flux catalog and instruction manual. Physical properties and application instructions included for product line. Charts and tables summarize alloy selection and properties. Products are indexed by major metal use. *All-State Welding Alloys Co., Inc., White Plains, N.Y.*

FREE BOOKLET SHOWS HOW TRANSITE® PIPE CUTS COSTS IN STORM WATER DRAINAGE & STORM SEWER SYSTEMS

Send for your copy today!

JM JOHNS-MANVILLE

Box 14, HP-11, New York 16, N. Y.

Please send me, without obligation, your facts and data booklet on Transite Pipe Storm Water Drainage and Storm Sewer Systems.

NAME____________________

ADDRESS____________________

CITY________________ ZONE______

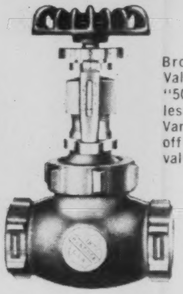
COUNTY________________ STATE______

Heating and Air Conditioning

FLOW

CONTROL

HANCOCK VALVES DO THE JOB *ECONOMICALLY*



Bronze "Flocontrol" Valves. ¼" thru 2". "500 Brinnell" stainless steel V-port disc. Variable orifice, shut-off and index in one valve.

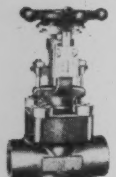
Reliable control of flow contributes substantially to complete owner satisfaction with every heating, piping, and air conditioning system you install.

Whether the application demands pin-point control of flow or full flow, Hancock Valve performance proves there is no substitute for the economy of quality. Highest operational perfection is combined with lowest maintenance. Whatever the piped medium — fuel oil, gas, water, or steam — the quality of Hancock Valves helps assure uninterrupted service. Typical advantages of Hancock Bronze and Steel Valves are:

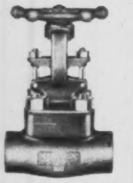
RUGGEDNESS that continues to ward off the deteriorating effects of wire drawing, galling, steam cutting, erosion and corrosion long after ordinary valves fail.

MAINTENANCE ECONOMY because carefully selected materials are precision-formed into functional parts of long-lasting efficiency. Servicing can be done in the line. Standardization of components means inventory economy.

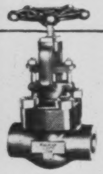
Learn all the job-proved reasons why Hancock Valves are today's best buy in terms of your standard of reliability. Globe, Angle, Gate, and "Flocontrol" types available with application characteristics suited to your heating, piping, and air conditioning requirements. *Write for Catalog 200A.*



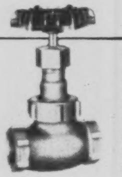
Steel "Flocontrol" Valves. ¼" thru 2". V-port disc compels proportional flow thruout the lift of the stem.



600# Steel Gate Valves. ¼" thru 2". Forged steel body. Maximum use of stainless steel.



600# Steel Valves. Globe and Angle. ¼" thru 2". Forged steel body. "500 Brinnell" stainless steel disc.



Bronze Valves. Globe and Angle. ¼" thru 2". "500 Brinnell" stainless steel seat and disc. 125% to 230% stronger diaphragm.

HANCOCK VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Valve Division • Watertown, Massachusetts
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ont.

WE HEAR THAT . . .

▶ *ROBERTSHAW-FULTON CONTROLS CO.* has opened its new *EASTERN RESEARCH CENTER* for the research and development of industrial, military, and other control devices. The $600,000 building has 18,000 sq ft of floor space.

▶ A new 30 minute, sound-color film, "Copper Tube in Building Construction," will be available to distributors for showing to contractor groups. The film is made available by *REVERE COPPER AND BRASS INC.*

▶ Construction of a 120,000 sq ft addition to *THE TRANE CO.* plant at Clarksville, Tenn., has recently begun. Slated for completion in February 1961, the project is being built at a cost of $1,200,000, and will bring the total plant area to more than 270,000 sq ft.

▶ *MUELLER CLIMATROL DIV. OF WORTHINGTON CORP.* has consolidated its Alhambra, Calif., engineering, sales, marketing, and accounting departments into the division's Milwaukee headquarters.

▶ *J. L. RICHARDS & ASSOCIATES LIMITED*, consulting engineers, have moved into new quarters at 864 Lady Ellen Place, Ottawa 3, Ontario.

▶ *MARBON CHEMICAL DIV., BORG-WARNER CORP.* — William A. Suiter and Rhoda M. Stewart, vice presidents.

▶ The *FENWAY MACHINE CO.*, Philadelphia, has moved to new and larger quarters at 1910 N. Marshall St.

▶ *NIAGARA WELDING & BOILER WORKS, INC.*, Niagara Falls, N.Y., is the new name of the former Niagara Weldments Inc. Concurrent with the name change was the introduction of three heat exchanger lines.

▶ *CORITE-REYNOLDS CORP.* is the name of the recently consolidated firms of Corite Products, Inc., and Reynolds Corp. The new firm has moved into larger quarters at 455 Jarvis Ave., Des Plaines, Ill. E. B. Brown, Jr. is president.

▶ *H. E. BOVAY, JR., CONSULTING ENGINEERS* has transferred George C. Love from Houston to the firm's Richland, Wash., office to assume the duties of chief engineer. R. O. Grimes will resume his position as associate and senior project engineer.

WE HEAR THAT

Continued

▶ The first of the *WALTON LABORATORIES'* Humidification Seminars for consulting engineers, mechanical contractors, and plant and building engineers was held in Chicago last month, and about 50 were present. Among the topics discussed were: estimating how much moisture is needed for different applications, selection of types of humidifiers, installation procedures, and other application information. Other seminars of this type are being planned for other areas of the U.S. by *WALTON LABORATORIES, INC.* as a means of dissemination of helpful information about humidification.

▶ Production facilities for an industrial heat insulation material for stainless steel piping, tanks, and other equipment are to be doubled in 1961 at *THE PHILIP CAREY MFG. CO.* plant in Lockland, O.

▶ *ALISCO CO., DIV. OF ALLMETAL SCREW PRODUCTS CO., INC.*, is the new name of the former Blumberg Supply Corp. Concurrent with the name change, the firm has moved to 809 Stewart Ave., Garden City, L.I., N.Y.

▶ The acquisition of a new facility has brought an additional 2000 sq ft to the *APEXTRO PRODUCTS CO.*, Los Angeles. Designated Apextro Plant No. 2, it will be used for expansion of warehousing and shipping operations.

▶ Approximately 30 research and development engineers at the Decatur, Ill. plant of the *YORK DIV. OF BORG-WARNER* will be transferred to the York, Pa. plant after the first of the year. Consolidation was desirable "because of the multiple application of products, especially compressors, used by both plants."

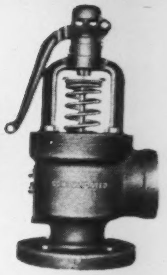
▶ *RECOLD CORP.*, Los Angeles, has completed an addition of 49,000 sq ft to their present plant. The total square footage is now 169,000. Concurrent with the expansion announcement, production plans that are expected to double the output of the firm's products were revealed.

▶ *MIDWEST PIPING CO.*, has opened a new sales office in Pittsburgh. William M. Bushman will be in charge.

▶ *E. M. MITTENDORFF* has resigned from the University of Virginia and has accepted an appointment with the International Cooperation Administration as Deputy Industry Officer in Tehran, Iran.

OVERPRESSURE

CONSOLIDATED
SAFETY VALVES
GIVE POSITIVE
PROTECTION



Type 1511 Safety Valve. Cast iron body. Maximum capacity for saturated steam. Sizes: 1½" through 6". Pressures to 250 psi. Temperatures to 450°F.

Make certain steam, air and gas pressures are held within safe limits on your heating, piping, and air conditioning projects. Consolidated Safety Valves automatically relieve overpressures in everything from package-type boilers and large steam generators to air tanks and other unfired pressure vessels. A 2100-pound design boiler is used to test and set these valves—to guarantee capacities and assure the best protection. Typical plus values of Consolidated Safety Valves are exemplified in the Type 1511:

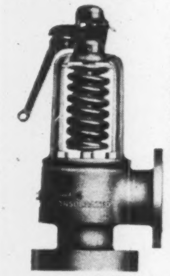
Compactness saves space and headroom; permits the use of smaller, more economical discharge piping.

Lower Cost per pound of steam discharged because maximum capacity is designed into minimum flange size. Fewer or smaller safety valves can be used on a boiler.

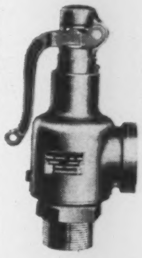
Better Alignment through double-guided adjusting ring and disc guide assures easier, more uniform blowdown adjustment and control, and finer operation.

Positive Tightness is created because the seat is machine-lapped to optical flatness.

On large or small installations, spring-loaded Consolidated Safety Valves give positive protection to personnel and facilities. Whatever the working pressures and temperatures of your heating, piping and air conditioning projects, choose Consolidated. Precision-made with few working parts, they are tough, long-life safety valves that rarely require maintenance. *Write for Catalog 700A.*



Type 1415 Safety Valve. Cast steel body. High capacity for saturated and superheated steam. Sizes: ½" through 6". Pressures to 900 psi. Temperatures to 900°F.

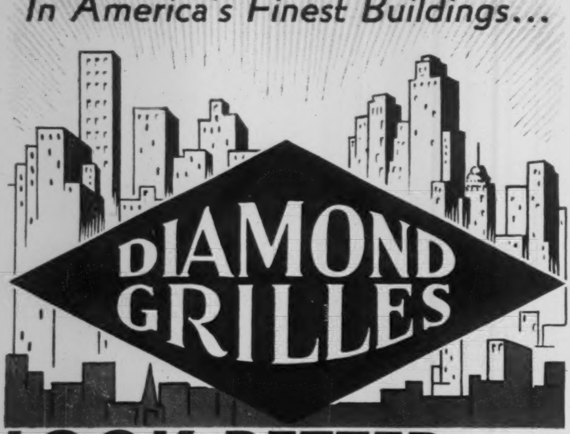


Type 1551 Safety Valve. Bronze body. For steam, air, gas. Sizes: ⅜" through 3". Pressures to 300 psi. Temperatures to 450°F.

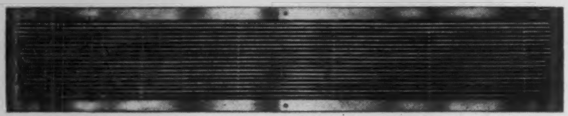
ASME Standard • ASME Tested • National Board Certified

CONSOLIDATED SAFETY VALVES
A product of
MANNING, MAXWELL & MOORE, INC.
Valve Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ont.

In America's Finest Buildings...

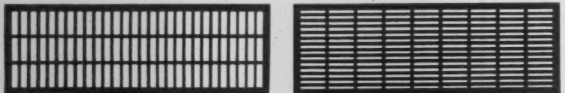


LOOK BETTER... LAST LONGER!

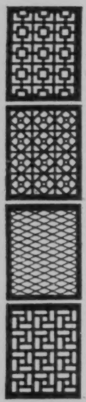


DIAMOND FABRICATED GRILLES

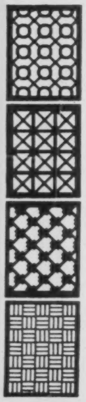
. . . meet the current demand for a very strong bar-type grille which provides more than the usual percentage of open area and is suitable, in general appearance, for use with practically any modern style of interior design. Specified by leading engineers and architects for Schools, Colleges, Hospitals, Ocean Liners, Sports Arenas, etc. Custom Built (no standard sizes) in any specified rectangular size or shape — All Steel or All Aluminum — for either direct or deflected air flow. Write for Bulletin 43.



DIAMOND ARCHITECTURAL GRILLES



. . . are stamped from Steel, Aluminum, Bronze or any other commercial metal; in a wide variety of artistic designs, in any desired thickness up to one-quarter inch, with correspondingly LARGE unit openings. Widely used, for nearly half a century, in America's finest buildings, they have proved practically indestructible — standing up for years against any probable amount of rough usage. Bulletin 41 illustrates and describes a number of popular designs and applications. Catalog 36 (100 pages) contains actual-size illustrations of ALL Diamond Grille designs, together with complete working data. Write for either or both — no charge or obligation.



DIAMOND MANUFACTURING CO.
Box 41 WYOMING PENNA.
(Wilkes-Barre Area)

▶ An additional 500 sq ft warehouse, now being built, is the first phase of a $75,000 expansion program for *THE MATHES CO., DIV. OF GLEN ALDEN CORP.*, Marble Falls, Tex.

▶ *WHEEL TRUEING TOOL CO.* will build a 50,000 sq ft plant on a 12 acre site in Plymouth, Mich. The structure is expected to be completed by September 1962.

▶ *HERSCHEL A. SOSNIN*, 234 Wyncote Rd., Jenkintown, Pa., announces his availability as a consultant to producers and users of pipe and piping components.

▶ *THE NOLAND CO.*, Newport News, Va., has purchased a 57,500 sq ft tract for the construction of a $750,000 building to house its general offices. Occupancy is expected by 1963.

▶ A 120,000 sq ft one floor plant is being built for the *MOTOR WHEEL CORP.*, La Grange, Ind. Completion of the facility is planned for late 1960, and production is expected to begin January 1961.

▶ *THE KORFUND CO.*, Long Island City, N.Y., has moved into its new quarters on Cantiague Rd., Westbury, N.Y. All manufacturing, engineering, sales, and administrative departments will be consolidated into the 34,000 sq ft building.

▶ The *AIRTHERM MFG. CO.* has appointed Evan S. Stein & Associates as exclusive factory representatives in the Chicago area.

▶ *PERMAGLAS DIV. OF A. O. SMITH CORP.*, Kankakee, Ill., has appointed Grant Advertising, Inc., as national agency for advertising and public relations.

▶ Establishment of a branch office and technical service center in Chicago has been made by *THE ALPHA-MOLYKOTE CORP.*

▶ *HAGEN MFG. CO.*, Delphos, O., entertained over 300 dealers and distributors at an open house ceremony for its new 50,000 sq ft factory and office.

▶ *J. A. MILLARD, P.E.*, 2201 Britt Ave., Fort Shawnee, Lima, O., has resigned his position as administrative engineer with the Saint Rita hospital in order to enter private practice as a hospital consulting engineer.

WE HEAR THAT

Continued

▶ A 36 acre tract in Visalia, Calif., has been acquired by *McQUAY, INC.* for the purpose of building a 45,000 sq ft branch factory. The facility is expected to be ready for occupancy in the spring of 1961.

▶ Production of standard fractional horsepower motors has started at the *WAGNER ELECTRIC CORP.* plant in Brinkley, Ark. The 90,000 sq ft building was dedicated in July.

▶ *WHITE-RODGERS CO.*, St. Louis, has acquired the gas burner manufacturing operations of Robinson Tube Fabricating Co., Conway, Ark. The operations of the new facility will be integrated with *CONFIGURED TUBE PRODUCTS CO.*, a wholly-owned subsidiary of White-Rodgers.

▶ A $250,000 expansion program has been launched by the *ELECTRO-AIR CLEANER CO., INC.*, McKees Rocks, Pa., with the breaking of ground for a 26,000 sq ft addition to its existing plant.

▶ A new 177,000 sq ft warehouse and a second "Sound Laboratory" will be built at the *GRANTLY ROAD* plant of the *YORK DIV. OF BORG-WARNER CORP.*, York, Pa. The "Sound Laboratory" is used to test equipment without the interference of noise.

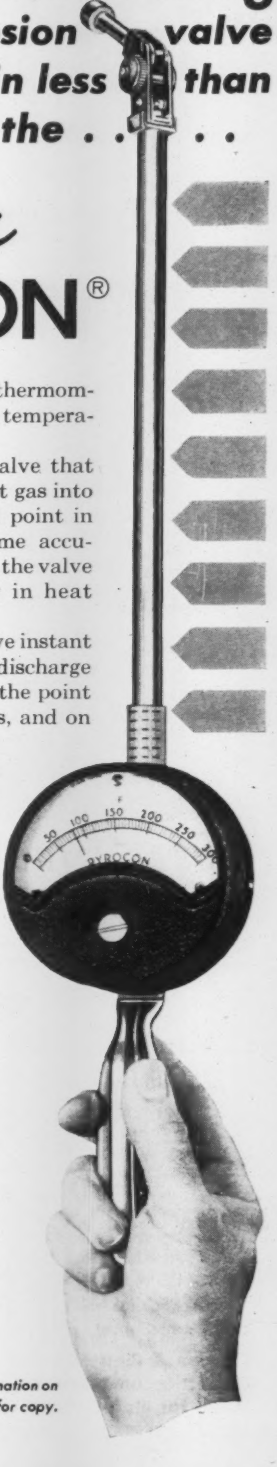
▶ Plans for a 100 acre research and engineering center has been announced by *CORNING GLASS WORKS*, Corning, N.Y. Construction of a pilot plant, housing nine melting furnaces and two process research departments, will begin immediately.

▶ *WELDED STEEL TUBE INSTITUTE, INC.*, is the new name of the former Formed Steel Tube Institute. The organization is located in Cleveland.

▶ A move to 22 W. Madison St., Chicago, has been made by the *AIR DISTRIBUTION INSTITUTE*, formerly of Cleveland. The move was made "to geographically centralize the activities of the organization."

▶ *BOHN ALUMINUM & BRASS CORP.* has begun construction of a 28,000 sq ft addition to its Danville, Ill. plant. About 2000 additional sq ft of dock space will also be constructed. Work is scheduled for completion before the end of the year.

▶ All research and development work has been consolidated into one department at the *CLEAVER-BROOKS CO.*, Milwaukee. The department will be located at the firm's plant in Waukesha, Wis., and will be under the direction of Russell Pipkorn.



For Air Conditioning

Thermal expansion valve set accurately in less than a minute with the . . . . .

Alnor PYROCON®

Eliminate the clumsy, slow thermometer method of determining temperatures in the system.

The thermal expansion valve that meters the flow of refrigerant gas into the cooling coil is a critical point in any cooling system. Extreme accuracy is necessary in adjusting the valve to obtain peak efficiency in heat absorption.

The Alnor Pyrocon will give instant temperature readings at the discharge side of the expansion valve, the point where heat absorption starts, and on the outlet of the coil where the total heat absorbed is registered. The temperature differential enables the operator to make a perfect setting of the expansion valve immediately.

Pyrocon model 4000 with a temperature range of 0-300° F. is recommended. Price with case including shielded thermocouple tip $125.00 f.o.b. Chicago.

The Pyrocon is also ideal for testing steam traps, balancing hot water systems, locating hot water pipes in cement floors, testing panel heating in walls, floors or ceilings, or making any surface temperature reading.

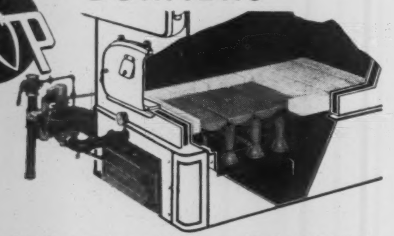
Other models with ranges up to 0-2000° F. and subzero ranges also available.

Bulletin No. 4257 contains complete information on the full line of Pyrocon instruments. Write for copy.

Alnor INSTRUMENTS

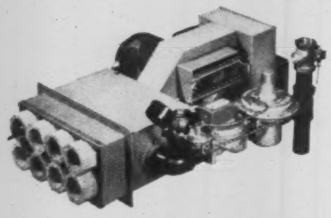
ALNOR INSTRUMENT CO.
Division of
Illinois Testing Laboratories, Inc.
Rm. 513, 420 N. LaSalle St., Chicago 10, Ill.

"Planned Performance"*
BURNERS



For heating and power boilers. 23 sizes listed in Catalog No. A-10.

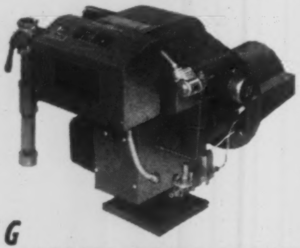
BLUE LINE UPSHOT ATMOSPHERIC GAS BURNER



Fully automatic, packaged assembly. Sizes listed to 28 million BTU/HR in Catalog C-10

TURBO-FIRE POWER TYPE GAS BURNER

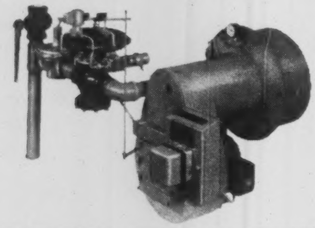
MODEL R
Capacities up to
2¼ million BTU/HR
Catalog E-61



TURBO-RING

FORCED DRAFT BURNERS
Gas, oil, or combination Gas-Oil burner. No stack required on boilers equipped for pressure firing.

MODEL FGR
Capacities 1 to 9
million BTU/HR
Catalog E-51



* PLANNED — Factory assembled, pre-wired for "Bolt-in" installation.

* PERFORMANCE — Custom matched to individual boilers for quiet, efficient operation.

Gordon & Piatt also manufacturer of a complete line of domestic conversion burners plus large dual-fuel units. Write for literature and complete information.

Gordon & Piatt
P. O. Box 914
Winfield, Kansas

WHO'S WHAT...

(New personnel, promotions)

▶ *BOHN ALUMINUM & BRASS CORP.* — Raymond J. Hodgson, member, board of directors.

▶ *M. H. DETRICK CO., INSULATION DIV.* — T. J. Pohl, sales manager.

▶ *WHITE-RODGERS CO.* — William L. Mayo, product manager; Edward E. Harwood, sales manager, original equipment manufacturer division; and John H. Martin, sales manager, wholesaler division.

▶ *ALLIS-CHALMERS MFG. CO.* — E. F. Greiwe, manager of all centrifugal pump departments; Joseph J. Jacobs, chief engineer; C. L. Babb, senior staff engineer; and W. W. Weltmer, senior development engineer.

▶ *ARGONNE NATIONAL LABORATORY* — Paul R. Hirsch, plant engineer.

▶ *A. M. BYERS CO.* — Robert D. James, manager, southwestern division.

▶ *CARRIER CORP.* — Allen W. Sherman, vice president, personnel.

▶ *RAYMOND J. RICE ENGINEERS* — Martin A. Haber, P. E., associate.

▶ *MODINE MFG. CO.* — A. G. Dixon, president; and C. T. Perkins, vice chairman, board of directors.

▶ *REPUBLIC STEEL CORP.* — Forrest H. Ramage, manager of sales, pipe division.

▶ *FARRIS ENGINEERING CORP.* — Frederick S. Rich, manager of Canadian operations.

▶ *CHESTER CABLE CORP.* — Benjamin Levinson, chief engineer; and Henry S. Loeber, sales manager.

▶ *THE DETROIT EDISON CO.* — Leo Collins, a member of HPAC's Board of Consulting and Contributing Editors, general superintendent of Central Heating; William Dull, assistant general superintendent; Carl Signor, supervisor of technical staff; and Joseph Cameron, superintendent, Beacon Heating Plant.

WHO'S WHAT

Continued

▶ *AUTOMOTIVE RUBBER CO.* — Philip T. Rogers, vice president and general manager, *ARCO-WYNN VALVE DIV.*

▶ *BABCOCK & WILCOX CO.* — Alden P. Taber, vice president in charge of the research and development division.

▶ *CLEAVER-BROOKS CO., FIRETUBE DIV.* — W. F. Zunker, sales manager; John J. Nash, assistant sales manager; and Paul Buday, head of the sales-engineering department.

▶ *CHAPMAN VALVE CO.* — Henry A. Porterfield, manager of advertising and sales promotion.

▶ *NATIONAL INDUSTRIAL SERVICE ASSOCIATION, INC.* — August A. Baechle, staff engineer.

▶ *TITEFLEX, INC.* — Milton L. Lundgren, industrial sales manager.

▶ *REPUBLIC-TRANSCON INDUSTRIES, INC.* — Val Plouffe, sales manager, commercial water heater division.

▶ *JOY MFG. CO.* — George R. Fox, vice president of manufacturing.

▶ *THE LAU BLOWER CO.* — William W. Morrisey, director of marketing.

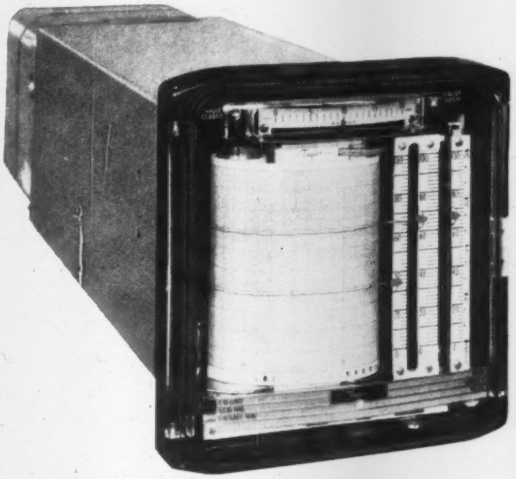
▶ *BORG-WARNER CORP.* — Frank W. Rickard, group vice president.

▶ *ILG ELECTRIC VENTILATING CO.* — Sherwin S. Tarnoff, sales engineer.

▶ *NU WAY-SUNDSTRAND CORP.* — Earl C. Thompson, director of engineering.

▶ *RECOLD CORP.* — D. D. Wile, executive vice president; E. V. Jarvis, vice president of finance; C. M. Wilson, vice president of sales; and C. R. Baumhofer, vice president of manufacturing. Mr. Wile remains as vice president, engineering, and Mr. Jarvis remains as secretary-treasurer.

EXCEPTIONAL CONVENIENCE



Transmitter
Recorder
Taylor
Controller
Valve

MODERN PROCESS CONTROL

No other recorder, regardless of size, puts so many features in so little panel space

The Taylor TRANSCOPE® Recorder (90J) is now generally recognized as the most modern, most convenient and most accurate instrument for recording process variables at a central point.

Servo-operated Pens assure unprecedented accuracy of records.

Front of Panel Control Settings let you make adjustments easier, quicker and better . . . *from the front of panel* . . . while recording!

Stays on Automatic Control while the plug-in recorder slide is removed for inspection, yet providing continuous fully automatic control.

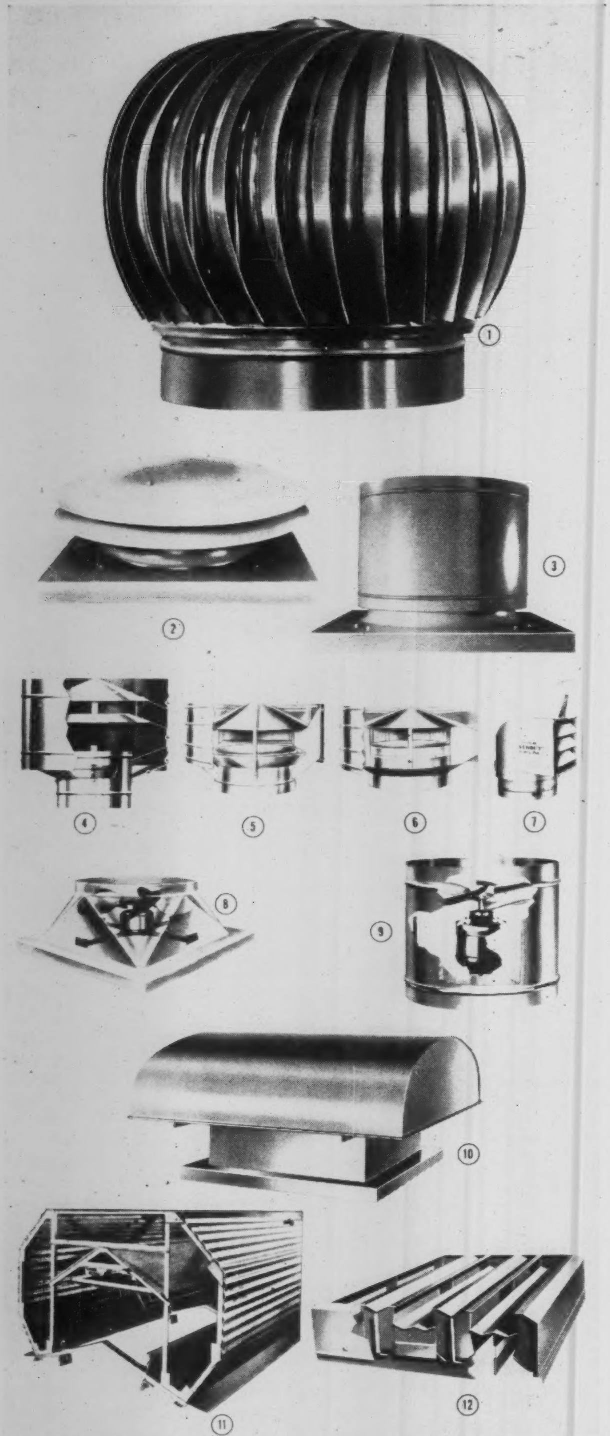
Complete Indicating Control Station while recorder is removed. Horizontal gage at top of recorder will show either process variable or air output to valve, as desired.

Recieves Three Variables to be recorded or indicated; has a Set Point Transmitter; Process Alarms with Memory Pointers; an Automatic-to-Mannual switching lever; a cascade or Process-output Indicator, and many other features . . . all in a compact case.

See your Taylor Field Engineer, or write for **Catalog 98286.** Taylor Instrument Companies, Rochester 1, N. Y., or Toronto, Ontario.

Taylor Instruments
MEAN ACCURACY FIRST

No Need to Look Further...



Write today for nearest representative

WESTERN
ENGINEERING AND MFG. CO.

P. O. Box 66455
Los Angeles 66, California

Complete Catalog in Sweets. Member Air Moving and Conditioning Assoc., Inc.

WHO'S WHAT

Continued

▶ *HOOKER CHEMICAL CORP.* — F. Leonard Bryant, executive vice president and member, board of directors; Thomas F. Willers, vice president and member, board of directors; and Werner P. Gullander, executive vice president and a director of General Dynamics Corp., elected a member, board of directors.

▶ *HENDRICK MFG. CO.* — Kenneth H. Colville, Jr., director of sales and advertising; and Benjamin G. Dann, Jr., director of production.

▶ *AMERICAN TUBE & CONTROLS, INC.* — Rudolph T. Schoerner, vice president, engineering.

▶ *REVERE COPPER AND BRASS INC.* — Edward S. Bunn, chief metallurgist, general manager research and development department.

▶ *PERMAGLAS DIV., A. O. SMITH CORP.* — James F. Donnelly, Jr., manager of advertising and sales promotion.

▶ *AMERICAN SOCIETY FOR TESTING MATERIALS* — Thomas A. Marshall, Jr., executive secretary.

▶ *ARKLA AIR CONDITIONING CORP.* — Dr. Philip Anderson, vice president of research and development, Evansville plant.

▶ *EMERSON ELECTRIC MFG. CO.* — William L. Davis, executive vice president.

▶ *CUSTOM-AIRE PRODUCTS* — Edwin G. Weed, sales manager.

▶ *DUNHAM-BUSH, INC.* — Henri Soumerai, director of research and development, air conditioning, refrigeration, heating, and heat transfer products.

▶ *ARMSTRONG CORK CO.* — Wayne Keller, vice president and general manager of International operations, elected director.

▶ *AMERICAN-STANDARD INDUSTRIAL DIV.* — James A. Wheeler, product manager, air conditioning department, air side.

▶ *TUBULAR DIV., THE NATIONAL SUPPLY CO.* — J. Huston Lobingier, district manager, Houston.

WHO'S WHAT

Continued

▶ *AIR REDUCTION SALES CO., DIV. OF AIR REDUCTION CO., INC.* — Roger W. Tuthill, manager of engineering.

▶ *BLACK AND DECKER MFG. CO.* — John L. Turnbaugh, manager Towson, Md. plant.

▶ *KILBURY MFG. CO.* — Minard B. Kilbury, president.

▶ *A. Y. McDONALD MFG. CO.* — Marshall E. Young, warm air heating and air conditioning specialist.

▶ *POPE AND EVANS CONSULTING ENGINEERS* — Joseph E. Robbins, partner and manager of the Defence Projects Div.

▶ A 90,000 sq ft addition is being added to the existing 170,000 sq ft facility of *WORTHINGTON CORP.* in Decatur, Ala. Completion is scheduled for 1961.

▶ *McCORD CORP.* — John T. Davis, advertising manager.

▶ *BOILER ENGINEERING AND SUPPLY CO.* — Joseph David, Chicago area sales manager.

▶ *RESEARCH-COTTRELL, INC.* — John E. Schork, director of manufacturing.

▶ *OAKITE PRODUCTS, INC.* — Peter J. Kornett, member, board of directors.

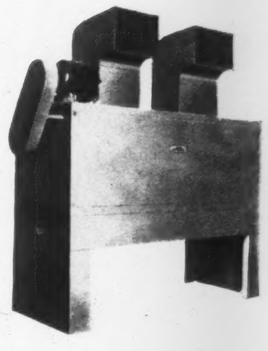
▶ *NIAGARA BLOWER CO.* — H. C. Roden, district engineer, Buffalo, N.Y.

▶ *RADIANT-RAY RADIATION, INC.* — Donald W. Erickson, vice president and sales manager, member, board of directors; Robert H. McKenzie, vice president.

▶ *MARBON CHEMICAL DIV., BORG-WARNER CORP.* — James Dennis, senior research chemist, research section; Richard Mundinger, senior coatings development, research section; Ralph M. Levine, group leader in charge of coatings and latices; and Jay Martin, group leader for rubber applications and evaluation.

USAIRCO

40 years experience in air handling units



Series 73 Heating, Ventilating Unit

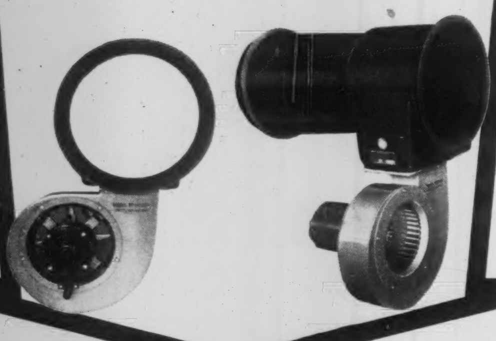
RUGGED CONSTRUCTION

Built for Efficient Performance, Long Life and Trouble-Free Operation

WRITE FOR PRODUCT BULLETIN 73

United States Air Conditioning Corporation
Delaware, Ohio

FOR MAXIMUM HEATING
OR EXHAUSTING EFFICIENCY
AT LOWEST COST



Patents 2,722,372 and 2,855,874 and Patents Pending plus Exclusive Foreign Patents.

...Specify

Quickdraft

POWER-DRAFT UNITS
DESIGNED FOR RESIDENTIAL,
COMMERCIAL AND INDUSTRIAL
APPLICATIONS

★ No motors, fans or bearings in exhaust line ★ Needs no stacks ★ Acid-resisting vitreous enamel finishes ★ Extremely high static pressures now available

FOR HEATING PLANTS AND INCINERATORS . . . *Quickdraft* provides constant draft for efficient and economical combustion. It eliminates pulsating or chattering, puffing, smoking and sooting. Costly, tall, unsightly stacks are unnecessary.

FOR INDUSTRY . . . *Quickdraft* now offers extremely high static pressures for EXHAUSTING corrosive gases, abrasives and paint sprays . . . for CONVEYING all types of bulk materials or wastes that can be moved by air.

FOR MOVING AIR in or out of buildings through ducts . . . *Quickdraft* is outstanding in performance and efficiency.

9010-QD

IMPORTANT NOTICE

To withstand corrosive gases, all *Quickdraft* units are available in standard acid-resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P. V. C.) and with plastic and Fiberglass coatings.

Quickdraft
Engineering
Data

Write today for Quickdraft Engineering Data.

Quickdraft
CORPORATION P. O. BOX 87-K, CANTON 1, OHIO

MEETINGS & CONVENTIONS

NOV. 10-12 — Consulting Engineers Council Semi-Annual Meeting. Penn-Sheraton Hotel, Pittsburgh. Information: Consulting Engineers Council, 326 Reisch Bldg., Springfield, Ill.

NOV. 14-17 — National Warm Air Heating and Air Conditioning Association Annual Convention. Statler-Hilton Hotel, Cleveland, O. Information: National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14, O.

NOV. 18-22 — Air-Conditioning and Refrigeration Institute Annual Meeting. Hollywood Beach Hotel, Hollywood Beach, Fla. Information: Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 19-22 — Refrigeration and Air Conditioning Contractors Association 15th Annual Convention. Fontainebleau Hotel, Miami Beach, Fla. Information: RACCA, 1028 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 27-DEC. 2 — American Society of Mechanical Engineers Winter Annual Meeting. Statler Hilton Hotel, New York, N.Y. Information: ASME, 29 W. 39th St., New York 18, N.Y.

NOV. 28 - DEC. 2 — 24th National Exposition of Power and Mechanical Engineering. Under auspices of the American Society of Mechanical Engineers. New York Coliseum. Information: International Exposition Co., Inc., 480 Lexington Ave., New York 17, N.Y.

DEC. 12-15 — Industrial Building Exposition and Congress. New York Coliseum. Information: Clapp & Poliak, Inc., Management, 341 Madison Ave., New York 17, N.Y.

1961

JAN. 23-26 — National Plant Maintenance & Engineering Show. International Amphitheater, Chicago. Information: Clapp & Poliak, Inc., Management, 341 Madison Ave., New York 17, N.Y.

Send for This Useful Reprint Volume

"CORRECT PRACTICE in INDUSTRIAL PIPING"

— All-New Third Edition —

196 Pages — 8½" x 11" — $1.50

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

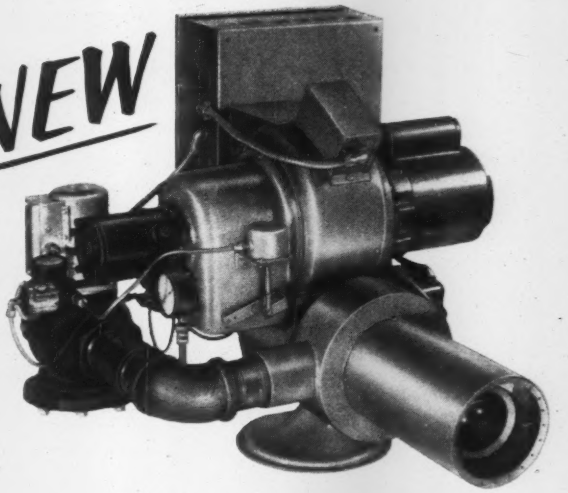
Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

Send $1.50 today for this book to the address below.

(on shipments outside U.S.A. or Canada, add 25c extra postage per book.)

KEENEY
PUBLISHING COMPANY
6 North Michigan Ave. Chicago 2, Illinois

NEW



SPACE-SAVING EFFICIENCY & FLEXIBILITY with the Roberts-Gordon "CYCLO-JET"

Here's the hottest news in years for commercial and industrial heating! Roberts-Gordon's *new*, complete line of "Cyclo-Jet" power pressure burners achieves a unique concept of peak efficiency fuel combustion in a truly compact package. It's the all-new "Cyclo-Jet" burner head that does it!

- **Positive Combustion Air Control Insures Maximum Fuel Economy**
- **Uniform, Compact Flame Pattern over Wide Firing Range**
- **Completely Automatic Control System**
- **Gas, Oil or Dual Fuel Gas/Oil Models**
- **Capacities to 2,600,000 BTU's/hr. input**

Factory assembled and tested, the "Cyclo-Jet" Burner is a *complete* fuel burning device and control system. Combining high efficiency with great compactness, the new "Cyclo-Jet" Burner Head is extremely flexible and simple to install.

Unique design of burner head forces gas and air into combustion chamber with cyclonic turbulence. This gives compact flame configuration with resulting high heat release, facilitating firing of equipment normally presenting difficult combustion problems.

Accurate combustion air control with either fuel eliminates need for induced draft fan or tall chimney. Fixed firing rate, two-stage or fully modulating gas control systems are available. Dual gas/oil burners are designed for quick manual or automatic fuel changeover. Low-fire start and pre- and post-purge are optional. Totally enclosed control panel is standard. Panel lights indicate when controls are energized. Electronic-interrupted pilot control system gives safe, positive main flame supervision. Fully factory guaranteed.

Cash In On the Profit Opportunities of the Revolutionary New "Cyclo-Jet" Power Pressure Burner Line NOW! Contact Your Roberts-Gordon Dealer or Write Us Direct.

ROBERTS GORDON

ROBERTS-GORDON
APPLIANCE CORP.
44 Central Ave., Dept. HP, Buffalo 6, N.Y.
In Canada — Grimsby, Ontario

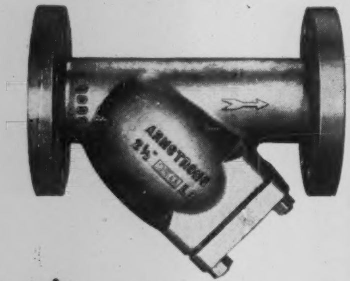
Low-Cost Insurance for a Major Investment

ARMSTRONG STRAINERS

—IN CAST SEMI-STEEL FOR PRESSURES TO 250 LBS. AS LOW AS $2.75

Pressure Regulators	$50 to $1000
Solenoid Valves	$50 to $800
Float Valves	$25 to $700
Steam Traps	$10 to $400

Armstrong cast semi-steel strainers with screwed ends are available in sizes from ¼″ through 3″. Cast carbon steel, cast chrome moly steel, stainless steel and cast bronze strainers also available.



ALSO AVAILABLE

Armstrong strainers with flanged connections, 2½″ through 6″ in cast semi-steel or cast carbon steel.

For details, ask for Bulletin 605. Ask your local Armstrong Representative, or write:

ARMSTRONG MACHINE WORKS
8748 Maple Street • Three Rivers, Michigan
See our catalog in Sweet's "Plant Engineering File."

Monarch NOZZLES For HUMIDIFYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼″ male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG I

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.
Canadian Agents: (Except B. C.)
E. S. Gallagher Sales Ltd., Toronto 12, Canada

MEETINGS & CONVENTIONS

Continued

FEB. 13-16 — *American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., semi-annual meeting.* Conrad Hilton Hotel, Chicago, Ill. Information: ASHRAE, 234 Fifth Ave., New York 1, N.Y.

FEB. 13-16 — *International Heating and Air Conditioning Exposition.* International Amphitheater, Chicago, Ill. Information: E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N.Y.

MARCH 27-31 — *Third National Symposium on Temperature — Its Measurement and Control in Science and Industry.* Sponsored by American Institute of Physics, Instrument Society of America, and National Bureau of Standards. Columbus, Ohio. Information: W. R. Tilley, National Bureau of Standards, Washington, D.C.

NEW BOOKS & REPORTS...

Ultrasonic Welding — Discusses fundamentals of the process, the metals which can be welded, welding techniques, weld characteristics, quality control, equipment, and applications. Booklet is a reprint of material published in Section 3 of the *Welding Handbook* (4th Edition). American Welding Society, 33 W. 39th St., New York 18. Price, $1.50.

Primer on Water — Written in two parts: part one covers the science of hydrology, which is concerned with the relation of water to earth; part two is concerned with the magnitude and use of the total water supply in the United States. Superintendent of Documents, Government Printing Office, Washington 25, D.C. Price, 50 cents.

Air Pollution Manual, Part 1, Evaluation — Technical treatise explaining procedures of evaluating air polution. American Industrial Hygiene Association, 14125 Prevost, Detroit 27. Price, AIHA members, $5.50; non-members, $8.50.

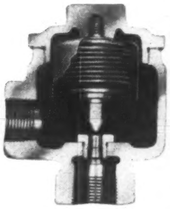
Energy from Uranium and Coal Reserves — Summarizes the domestic and world uranium reserves and resources, the recoverable coal reserves, and compares the maximum heat energy from the uranium and coal reserves. Office of Technical Services of the Business and Defense Service Administration, U. S. Department of Commerce, Washington 25, D.C. Price, 50 cents.

R I G G I O

THERMOSTATIC STEAM TRAPS

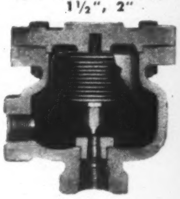
FOR MAXIMUM EFFICIENCY CHOOSE FROM THIS LINE OF RIGGIO THERMOSTATIC STEAM TRAPS

For pressures from Vacuum to 200 lbs.
Bronze Construction
½", ¾", 1"



TYPE A-200
Freeze-Proof

For pressures from Vacuum to 250 lbs.
Semi-steel Construction
½", ¾", 1", 1¼", 1½", 2"



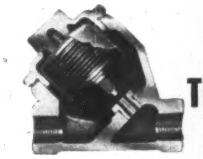
TYPE C-250
Freeze-Proof

Simple

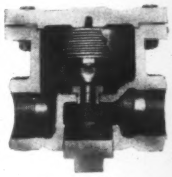
Rugged

Versatile

Tight Shut-off



TYPE Y-200



TYPE B-250

For additional information contact

FRANK D. RIGGIO CO., INC
State Highway 17, Rutherford, New Jersey
Phone Webster 9-8450

Statement of Ownership and Management of
HEATING, PIPING & AIR CONDITIONING
for October 1, 1960

The following is a statement of ownership, management, etc., as required by the act of Congress of August 24, 1912, as amended by the acts of March 3, 1933, July 2, 1946 and June 11, 1960 (74 Stat. 208) of Heating, Piping & Air Conditioning, published monthly at Chicago, Ill., for October 1, 1960:

1. The names and addresses of the publisher, editorial director, editor, and president are:

Publisher, Chas. E. Price, 1120 Greenleaf, Wilmette, Illinois.
Editor, Robert W. Roose, 911 S. Catherine Ave., LaGrange, Illinois.
Editorial Director, C. M. Burnam, Jr., 9215 S. Damen, Chicago, Illinois.
President, Chas. E. Price, 1120 Greenleaf, Wilmette, Illinois.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stocks. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member must be given.)

Keeney Publishing Company, 6 North Michigan Avenue, Chicago 2, Illinois. Stockholders: Chas. E. Price, 1120 Greenleaf, Wilmette, Illinois; Robert A. Jack, 3565 Glen Allen Dr., Cleveland Heights, Ohio; W. J. Osborn, 1029 Old Post Rd., Fairfield, Connecticut.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 17,867.

Chas. E. Price, President

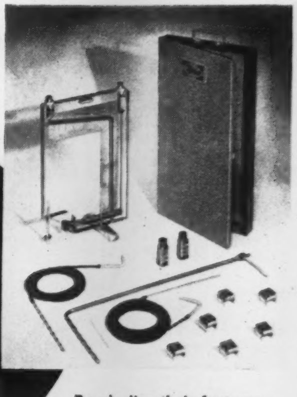
Sworn to and subscribed before me this 12th day of September, 1960.

Lydia Thomas.
(SEAL) [My commission expires November 21, 1963]

Dwyer
CONTROLS GAGES

AIR VELOCITY METER No. 400

One Instrument Tells Both Air Velocity and Static Pressure!



- **Reads directly in feet per minute and inches of water.**
- **Check *all* velocities from 400 to 10,000 F.P.M.**
- **All static pressures from 0 to 10" of water.**

Tests fan and blower discharge and inlet pressures, pressure drop across filters, balances air conditioning systems, etc. Complete kit includes dual purpose manometer, 18" stainless steel pitot tube, Magneclips and all necessary fittings, tubings, instructions and accessories.

Write today for literature and prices.

F. W. DWYER MFG. CO.
P. O. BOX 373-H **MICHIGAN CITY, INDIANA**

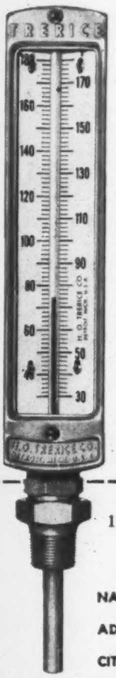
NEW! The high quality of

STAINLESS STEEL

. . . at lower cost!

TRERICE BX SERIES ***INDUSTRIAL***

THERMOMETERS



Now available! The new high-quality, low-cost Trerice BX Series Thermometer with stainless steel front and bulb chamber. Easy-to-read scale markings . . . large red appearing mercury tube . . . durable 9-inch cast aluminum case. Guaranteed accurate temperature indication! Available in standard range models from —40°F to 950°F. No extra cost for straight, right side, left side, regular angle, regular oblique, or reverse oblique forms.

H. O. TRERICE CO.
1420-C W. Lafayette Blvd., Detroit 16, Mich.
Please send bulletin 201 describing Trerice BX Industrial Thermometers!

NAME______________________________
ADDRESS___________________________
CITY________________ZONE_____STATE________

TRERICE TEMPERATURE AND PRESSURE INSTRUMENTS

IDEAL

No. 40 Ideal

Ace Tube Expander

a leader in the field for more than 50 years!

for general boiler work

Preferred for re-rolling tubes in package and stationary fire tube boilers. Insist on WIEDEKE nationally known Ideal Tube Expanders.

See Your Dealer or Write us for Bulletin No. 40

The Gustav WIEDEKE Company
Dayton 1, Ohio

NEW BOOKS & REPORTS

Continued

Air Conditioning Systems for Other Than Residences — NFPA No. 90a is a set of standards on the subject of fire safety in regard to air conditioning, ventilating, and warm air heating systems. National Fire Protection Association, 60 Batterymarch St., Boston 10. Price, 50 cents.

OTS Selected Bulletins — Listing latest government research reports and other technical information.

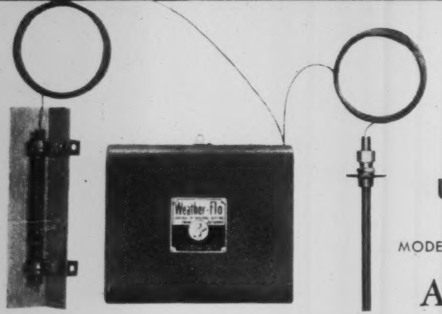
Cooling Methods and Equipment for Supersonic Aircraft — Price, $3.00.

Closed Circuit Respiration/Ventilation System, Phase 1 — Price, $2.50.

Available from the Office of Technical Services of the Business and Defense Services Administration, U.S. Department of Commerce, Washington 25, D.C.

Handbook of Chemistry and Physics (42nd Edition) — One-source manual covers mathematics, physics, and chemistry in one volume. The Chemical Rubber Co., Publications Div., 2310 Superior Ave., Cleveland 14, O. Price, $12.00 ($12.50 outside U.S.A.).

WEATHER-FLO®



MODELS "FS" and "MFS"

CUTS FUEL BILLS AS MUCH AS 25%, USERS REPORT

OUTDOOR WEATHER-SENSING
COMFORT CONTROL
FOR HOT WATER AND WARM AIR SYSTEMS

- Effects more continuous circulation of water or air at right temperature for greatest comfort.
- Delivers equal heat to remote or near rooms.
- Eliminates air stratification, "cold 70° at ankle level."
- For residential, commercial, industrial installations.
- *Fully field-adjustable*—can be installed by any qualified serviceman.
- Provides maximum accuracy of adjustment with greatest flexibility. All adjustments calibrated in actual temperature settings.

Write for Bulletin W-658-H.

AUTOMATIC WEATHER CONTROL® DEVICES

DIVISION OF AMERICAN MACHINE AND METALS, INC.
SELLERSVILLE, PENN.

For leakproof, pressure-tight connections..

TiteSeal®
Gasket & Joint
SEALING COMPOUNDS

BRUSH-ON
TiteSeal
LIQUID-TYPE NON-HARDENING
GASKET & JOINT SEALING COMPOUND

Heat-proof, vibration-proof. Will not shrink, crack or crumble. Prevents formation of rust and corrosion—makes disassembly easy.

7 Basic Blends

SOLDER SEAL

At your wholesaler!

2194

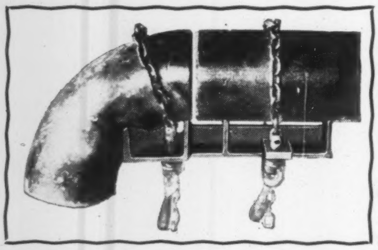
RADIATOR SPECIALTY CO., Charlotte, N. C.

. . . enough JEWEL clamps cut erection costs

PIPE WELDING CLAMPS

Jewel Pipe Clamps are lightweight — rigidly constructed — resist strain, heat and abuse.

FOR WELDING PIPE • FLANGES • ELBOWS • ANGLES —also PIPE MARKERS



Jewel Clamps align pipe perfectly, and hold it there until it is welded. Two sizes, 1/2" to 8"; 8" to 16". Write for details.

JEWEL
MANUFACTURING CO.
1841 University Ave.
St. Paul 4, Minnesota.

DOLE
Heat-Cel

LOW TEMPERATURE
AUTOMATIC
DEFROST
RE-EVAPORATOR UNIT

FAST HEAT TRANSFER FOR QUICKER DEFROSTING!
Heat for re-evaporation supplied by low wattage electrical element. Consistent, economical, performs in any ambient. Designed by specialists in the low temperature field. Get all the facts. Write for Heat-Cel engineering catalog.

DOLE REFRIGERATING COMPANY
5924 NORTH PULASKI ROAD, CHICAGO 46, ILLINOIS
103 PARK AVENUE, NEW YORK 17, N.Y.
DOLE REFRIGERATING PRODUCTS LIMITED
OAKVILLE, ONTARIO, CANADA

ELECTRIC

*
Heat-Cel
CONVENIENT PLATE DESIGN
ALLOWS FLAT-AGAINST-WALL MOUNTING

. . . find what you need quickly
and economically through . . .

CLASSIFIED ADVERTISING

Rates for classified advertising are 20 cents for each word including heading and address. One inch $8.00. Count nine words for keyed address. Minimum $3.00 for each insertion. Cash must accompany order. Closing date 10th of month preceding issue.

✓ SITUATIONS OPEN

REGIONAL SALES MANAGER — National manufacturer seeking aggressive sales engineer experienced in comfort conditioning field preferably hot water heat. Age 30 to 45. B.S.M.E. or comparable work experience. Prefer successful background in promoting sales to architects and engineers at national level. Headquarters · Chicago area. Salary open. Our personnel know of this ad. Send resume to Key 1496A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

SALES ENGINEER-EXECUTIVE — Outstanding opportunity for aggressive, experienced, sales-minded engineer with management qualities. Engineering contracting firm, specializing in high velocity systems, requires high caliber man to head operations in the New York area. Send resume to Key 1495A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

DESIGN AND DEVELOPMENT ENGINEER — Challenging opportunity for research minded engineer with degree in either mechanical or electrical engineering. Should have a minimum of four years' experience in the design of small mechanical appliances for mass production. Position requires planning and conducting projects of major scope with a minimum of supervision and coordinating the work of other engineers and technicians assigned to the project. Please submit resume and salary requirements to:

Personnel Administrator
American-Standard
Research Department
Plumbing and Heating Division
834 East Broadway
Louisville 4, Kentucky

VENTILATION ENGINEER — Our increasing expansion program and continuing growth of commercial applications for Beryllium metal has created an opening for an engineer with extensive experience in design of exhaust ventilation for chemical and metallurgical processes. Graduate preferred but experience of proper type acceptable in lieu of degree. Must be U. S. citizen.

Liberal company benefits include comprehensive insurance, pension, and hospitalization plans. Send complete resume including salary requirements to:

J. B. Gandy

Supervisor of Technical Employment

THE BRUSH BERYLLIUM COMPANY

ELMORE, OHIO

✓ AGENTS WANTED

MANUFACTURER'S AGENTS

An established manufacturer with 25 years experience, producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans.

The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators. Please reply Key 1361A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

✓ LINES WANTED

I'M TIRED OF BEATING MY HEAD OFF — Mfrs. Rep. with entree into every engineering office and all mechanical contractor shops in North Jersey wants a prime product, that can either be specified tight or is priced to take its share of the market under competitive conditions. Address Key 1499A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

CANADIAN SUBSIDIARY? Two sales engineers with ten years experience in heating, ventilating and air conditioning sales representation, consulting engineering and contracting wish to form and manage a Canadian company that will serve as the sales outlet for a maximum of three U. S. manufacturers having complimentary lines. Address Key 1497A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Competitive HVAC lines wanted for Florida by multi-office statewide manufacturers' representation being formed by experienced Floridian presently an executive for major manufacturer skilled in marketing with strong record of financial success. Address Key 1493A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

✓ SITUATION WANTED

CHIEF MECHANICAL ENGINEER — Present position includes responsibility for design and productive efficiency of large department of heating, air conditioning and plumbing engineers for large firm handling all types of construction. Excellent administrative record plus extensive client contact and construction supervision. Desire transfer to East Coast or vicinity to similar top level position. Resume available. Address Key 1498A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

✓ NAMEPLATES

IDENTIFICATION NAME PLATES for controls and panels — precision engraved on bakelite or black anodized alum. — any titles — quick service by mail on small or large jobs. — send for sample and prices. ATLANTIC ENGRAVERS, Coldbrook Road, Wilmington, Vermont.

VALVE TAGS & PRESSURE-SENSITIVE PIPE MARKERS for immediate shipment. Free Samples. Seton Nameplate Co., New Haven 15, Conn.

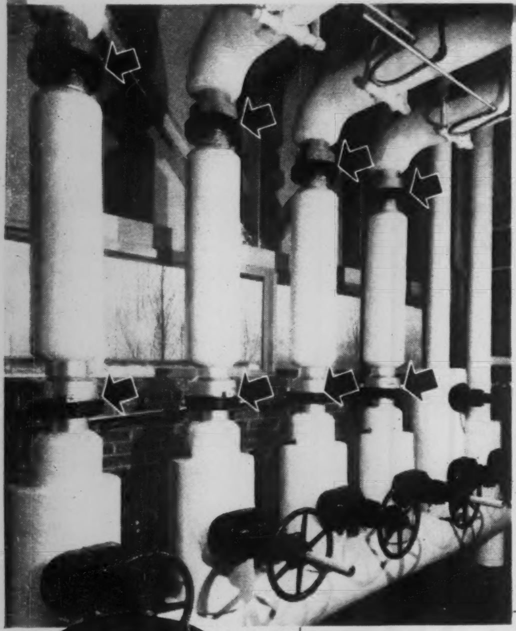
✓ SITUATION WANTED

Exec. Sales or Mfrs. Rep. 24 years sales and engineering exp. heating, ventilating, combustion and draft equip. Age 47. Graduate engineer. Address Key 1494A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

✓ AGENTS WANTED

REPRESENTATIVES WANTED — Manufacturer offering new quality line of registers, grilles, ceiling diffusers, etc. is looking for manufacturers' agents in many sections of the country and is offering exclusive territories, liberal commission basis. This top quality line is an excellent addition for agents handling HVAC equipment and calling on architects, engineers, contractors, etc. Please reply Key 1501A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

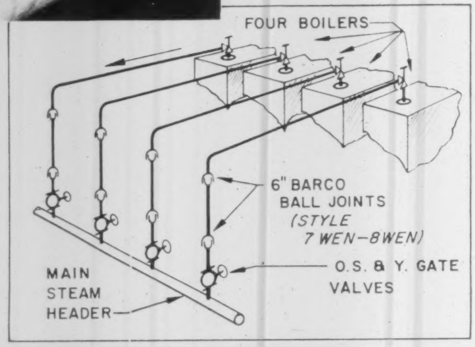
Barco Solves Boiler Piping Expansion Problem



Relieves Strain on Valves

This photograph shows an interesting new installation of eight Barco Flexible Ball Joints (see arrows) on four 250 psi boiler steam lines in a West Coast industrial plant. The schematic diagram (below) shows the piping layout.

Due to the fact that operation of individual boilers is intermittent, complicated expansion, contraction, and torsional movements occur in the piping. All of these movements are easily accommodated with the aid of the Barco Joints, relieving reactive forces on the valves.



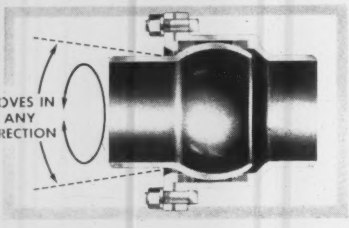
BARCO

BALL JOINTS

1. **Handle Expansion**
2. **Relieve Torsion**

PROBLEM—Originally, in the plant shown above, it was thought that the "spring" in the long runs of piping would take care of *thermal expansion* and *torsional stresses.* SUCH WAS NOT THE CASE. Serious trouble was encountered, tending to crack valve flanges and twisting so they would not seat tight.

ANSWER—Barco Ball Joints solved the problem, LOGICALLY, SIMPLY, ECONOMICALLY. These rugged all-steel joints have no thin wall sections, no critical points of fatigue, no rubber seals. They are practically indestructible. They provide points of flexibility in piping. Easy to engineer. They fit right in the piping; develop no "end thrust"; require no expensive anchoring. Sizes and styles to meet your requirements. *Send for catalog and information.*



BARCO MANUFACTURING CO.
541M Hough Street, Barrington, Illinois
In Canada: The Holden Co., Ltd., Montreal

INDEX TO ADVERTISERS

Firms represented in this issue are identified by the page on which their advertising appears. Advertising in other issues is marked with an asterisk.

A & A Register Co., The . . . . *
ACF Industries, Inc. W-K-M Div. 190
Acme Industries, Inc. . . . . *
Adsco Div., Yuba Consolidated Industries, Inc. . . 93
Aerofin Corp. 211
Aerovent Fan Co., Inc. . . . . *
Aimco Products Corp., Div. of Yuba Consolidated Industries, Inc. . . . . *
Air & Refrigeration Corp. . . . . *
Air Conditioning & Refrigeration Institute . . . 266
Air Conditioning Inc. 66, 67
Air Devices, Inc. 68
Airflow Controls Co. . . . . *
Air-Maze Corp. . . . . *
Airtherm Mfg. Co. 103
A-J Mfg. Co. 240
Aladdin Heating Corp. 241
Albertson & Co., Inc. . . . . *
Alco Valve Co. 187
Allen-Bradley Co. 213
Allen-Sherman-Hoff Co., The . . . . *
Allied Chemical Corp., General Chemical Div. . . *
Allied Metal Hose Co. 80
Allied Piping Products Co. . . . . *
Alnor Instrument Co., Div. of Illinois Testing Laboratories, Inc. 247
American Air Filter Co., Air Filter Div. . . 58, 59
American Chain & Cable Co., Inc.—RP&C Valve Div. . . . . *
American Gas Association 90, 91
American Hard Rubber Co. . . . . *
American Sisalkraft Corp. 219
American-Standard Industrial Div. 92
American-Standard, Plumbing & Heating Div. 102, *
American Vulcathene Div. of The Nalge Co., Inc. . *
Ames Iron Works . . . . *
Ammerman Co., Inc. 262
Anaconda American Brass Co. 72
Anaconda Metal Hose Div., Anaconda American Brass Co. 89
Anderson Co., V. D. Div. of International Basic Economy Corp. . . . . *
Anemostat Corp. of America . . . . *
Arkla Air Conditioning Corp. 90, 91
Arkos Mfg. Co. . . . . *
Armstrong Cork Co. 107
Armstrong Machine Works 88, 254
Arrow-Hart & Hegeman Electric Co. 35, 36
Aurora Pump Co. 199
Automatic Devices 256
Automatic Sprinkler Corp. of America, Auto Grip Div. . . . . *

Babbitt Steam Specialty Co. 236
Babcock & Wilcox Co., Tubular Products Div. . . 3
Badger Mfg. Co. 209
Barber-Colman Co. 52, 53
Barco Mfg. Co. 258
Barry Blower Co. 6
Bell & Gossett Co. 13, 179
Bethlehem Steel Company 54, 55
Binkley Bolted Framing Sales Co. . . . . *
Binks Mfg. Co. 227
Bituminous Coal Equipment, Inc. . . . . *
Boiler Engineering & Supply Co., Inc. 226
Bohn Aluminum & Brass Corp. 205
Bonney Forge & Tool Works 191
Bruner Corp. 265
Bryant Mfg. Co., The . . . . *
Buensod Stacey, Inc. 95
Buffalo Forge Co. . . . . *
Buffalo Pumps, Inc., Div. of Buffalo Forge Co. . . 45
Burgess-Manning Co. 207
Burnham Corp. 31
Byers Co., A. M. . . . . *

Cabot, Inc., Samuel . . . . *
Cambridge Filter Corp. . . . . *
Campbell Heating Co. 94
Capitol Pipe & Steel Products, Inc. . . . . *
Carnes Corp. . . . . *
Carrier Air Conditioning Co. 79
Cash Valve Mfg. Corp., A. W. . . . . *
Celanese Corp. of America . . . . *
Century Electric Co. . . . . *
Charles Machine Co., Inc. 220
Chase & Sons, Inc. . . . . *
Chatleff Controls, Inc. 264
Chicago Blower Corp. 4
Chicago Pump Co. . . . . *
Chrysler Corp., Airtemp Div. . . . . *
Clarage Fan Co. . . . . Inside Back Cover
Cobra Pipe Supply & Coil Co., Inc. . . . . *
Colonial Plastics Mfg. Co. Subsidiary Van Dorn Iron Works Co. 224
Combination Pump Valve Co. 220
Committee of Steel Pipe Producers . . . . *
Connor Engineering Corp. . . . . *
Continental Mfg. Co. 98
Continental Air Filters, Inc. . . . . *

Davidson Fan Co. . . . . *
Davis Eng. Co. . . . . *
Detroit Stoker Co. . . . . *
DeZurik Corporation 217
Diamond Mfg. Co. 246

Continued on page 260

IMPORTANT ANNOUNCEMENT

to people who hear voices*

*voices that intrude or disrupt and noises that project when they should be hushed.

The new Aircoustat® Model W Return Air-Vent Silencers stop the transmission of noise without blocking air flow

Aircoustat Return Air-Vent Silencers eliminate the distracting sound of voices that spill from one area to another. Their slim design gives you a choice of installation. You can install them within a wall or ceiling or hang them on doors or walls. Let Koppers long experience in sound control help you. Write today for information to: KOPPERS COMPANY, INC., 3311 Scott Street, Baltimore 3, Maryland.

Model W Return Air-Vent Silencer

In sizes for all applications:

Model	Thickness	Width	Length
W-1	3½″	30″	48″
W-2	3½″	42″	48″
W-3	5″	30″	48″
W-4	5″	42″	48″
W-5	7″	30″	48″
W-6	7″	42″	48″

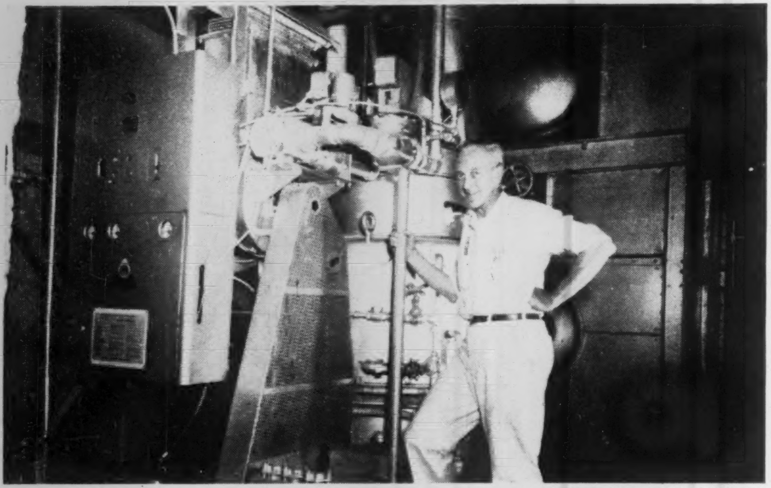
KOPPERS

SOUND CONTROL

METAL PRODUCTS DIVISION

® ***Engineered* Products Sold with *Service***

"NO MORE BOILER ROOM SPACE ...BUT WE NEEDED MORE STEAM"



Chief engineer Porter Murphy beside 150 bhp Vapor Modulātic Water Tube Boiler which was fitted into small space at rear of old boiler.

Strong Cobb Arner solved this problem with a Vapor Modulātic Water Tube Boiler

Strong Cobb Arner, Inc., of Buffalo, N. Y., (developer and producer of drugs, chemicals and allied products), had increased production to a point that consistently overtaxed their boiler 150 to 200%...but there was very little space remaining in their boiler room.

Chief engineer Porter Murphy studied two solutions: (1) Enlarge the boiler room and install a bigger boiler. This meant considerable cost, and an indefinite suspension of production during the change. Or, (2) Add as much bhp as possible in the existing space, using a compact packaged boiler as a booster for periods of high steam demand.

Since the original boiler was still in good condition, Plan 2 was used. A 150 bhp Vapor Modulātic Water Tube Boiler was fitted in a 5' x 8' area behind the main boiler. Delivered completely assembled, wired, and tested, the Vapor Modulātic needed no special foundations or other expensive construction.

Although the Vapor Modulātic was meant to be a "booster," it has frequently been used to supply the main steam load when requirements do not exceed 150 bhp. In its first nine months of operation, the Vapor Modulātic saved an estimated $2300 in operating costs.

• Compact • Efficient • Economical

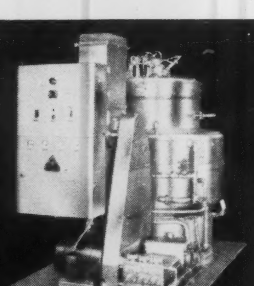
VAPOR MODULĀTIC WATER TUBE BOILERS

for processing, power, heating

Delivered fully assembled. Can be installed in hours—in spaces too small for ordinary boilers. No special foundation or stacks needed. Delivers full steam in five minutes from cold start.

BRIEF SPECIFICATIONS

Sizes	18 to 200 bhp
Pressures	5 to 900 psi
Fuel	Oil, Gas, or Combination
Floor Area (150 hp)	5 ft. x 8 ft.
Height (150 hp)	6 ft. 10 in.
Floor Load (max.)	150 lb./sq. ft.
Operation	Automatic



Send coupon for free literature.

VAPOR HEATING CORPORATION, Dept. 21-K
80 E. Jackson Blvd., Chicago 4, Ill.

Please rush me your free bulletins on Modulātic Water Tube Boilers.

NAME________

TITLE________

FIRM________

ADDRESS________

CITY, ZONE, STATE________

BHP REQUIRED________

SAFETY VALVE SETTING________

MINIMUM STEAM LOAD________

MAX. STEAM LOAD________

STEAM PRESSURE________

TYPE OF FUEL________

INDEX TO ADVERTISERS

Continued from page 258

Dodge Mfg. Co. 178
Dole Refrigerating Co. 257
Dravo Corp. *
Dunham-Bush, Inc. 16, 17
Durabla Mfg. Co. *
Duriron Co., Inc. The *
Duro-Dyne Corp *
Dwyer Mfg. Co., F. W. 255

Eagan Co., Inc., Walter H. 230
Enterprise Engine & Machinery Co., Adel Div., General Metals Corp. 222
Erie Tool Works *

Fairbanks Co. The 180
Fairbanks Morse & Co. 96
Farr Co. 218
Farris Engineering Corp. *
Fedders Corp. *
Field Control Div. Conco Engrg. Works, Inc. 84
Fiese & Firstenberger Mfg. Inc. 216
15th International Heating & Air Conditioning Exposition 261
Flexible Tubing Corp. 203
Flexonics Corp., Subsidiary of Calumet & Hecla, Inc. 75
Flintkote Co., The, Van-Packer Div. 177
Fluor Products Co. 34
"Freon" Products div., duPont de Nemours & Co. Inc., E. I. *
Frick Co. 170
Fuller Co., Lehigh Fan & Blower Div. *
Fulton Sylphon Div., Robertshaw-Fulton Cont. Co. 204

General Controls Co. *
Goodall Rubber Co. *
Goodrich Chemical Co., B. F. *
Goodrich, B. F., Sponge Rubber Div. *
Gordon & Piatt, Inc. 248
Governair Corp. *
Greenlee Tool Co. 100, 101
Gregory Industries, Inc. *
Grinnell Co., Inc. Inside Front Cover
Gustin-Bacon Mfg. Co. 71

Halstead & Mitchell 69, 70
Hansson, Elof, Inc. 105
Hastings Air Control, Inc. 221
Havens Cooling Towers div. of Havens Structural Steel Co. *
Hayes Furnace Mfg. & Supply Co. *
Heat-Timer Corp. *
Henry Valve Co. *
Hoffman Specialty Mfg. Corp. 10
Homstead Valve Mfg. Co. *
Hussey & Co., C. G. *
Hydrotherm, Inc. 214

Ilg Electric Ventilating Co. 189
Illinois Testing Laboratories, Inc. 247
Imperial Damper Co. 194
Independent Register Co., The 212
Industrial & Biochemicals Dept., E. I. du Pont de Nemours & Co., Inc. 263
Industrial Acoustics Co., The 7
Industrial Combustion, Inc. 202
Insul-Fil Co. *
Ingersoll-Rand Co. *
International Boiler Works Co., The *
Iron Fireman Mfg. Co. 85

Jackes-Evans Mfg. Co. *
Janitrol Heating & Air Conditioning Div., Midland-Ross Corp. *
Jenkins Bros., Inc. 184
Jenn-Air Co., Inc. 38
Jewel Mfg. Co., Inc. 256
Johns-Manville 64, 65, 243
Johnson Co., S. T. *
Johnson Heater Corp. 237
Johnson Service Co. Outside Back Cover
Jones & Laughlin Steel Corp. *

Keckley Co., O. C. 228
Klipfel Valves, Inc., div. of Hamilton-Thomas Corp. 234
Koppers Co., Inc., Sound Control Dept. 259

LaFavorite Rubber Mfg. Co. *
Lau Blower Co., The *
Lennox Industries, Inc. 24
Leslie Co. 48, 49

Continued on page 262

"Rather primitive heating, what?"

There's no reason to get into a stew over heating problems when you can get all the facts about modern heating practice at the Heating & Air-Conditioning Exposition.

At the exposition you can obtain first-hand information and money-saving tips on new heating equipment as well as the latest developments in refrigeration, air conditioning and ventilation equipment.

The more than 500 fact-filled displays will be staffed by top executives and key technical personnel prepared to provide you with information concerning more efficient methods of installation, maintenance techniques, use of related equipment, anything they know from which you can profit.

It will pay you to keep up with new developments by visiting this great concentration of equipment for heating, refrigeration, air conditioning and ventilation covering domestic, commercial and industrial applications.

15th International Heating & Air-Conditioning Exposition

Auspices ASHRAE

International Amphitheatre • Chicago, Illinois • Feb. 13-16, 1961

Management: INTERNATIONAL EXPOSITION COMPANY • 480 Lexington Ave., New York 17, N. Y.

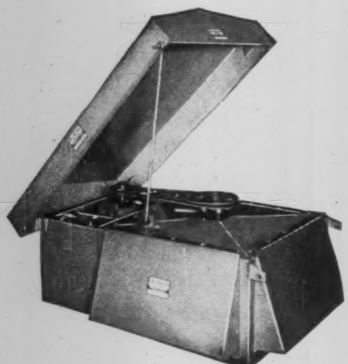
2733

AirMpeler

LO-BOY

CENTRIFUGAL
ROOF EXHAUSTERS

Enhance the Beauty of Building Skylines



Pats.
Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- QUALITY ● BEAUTY
- PROVEN PERFORMANCE

Write for bulletin Ha-100 60

AMMERMAN CO., INC.

P.O. Box 182
Stillwater. Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

INDEX TO ADVERTISERS

Continued from page 260

Liquidometer Corp. *
Longyear Co., E. J. 264
Lunkenheimer Co., The 83

Mammoth Furnace Co., The *
Manning, Maxwell & Moore, Inc., Gauge and Instrument Div. *
Manning, Maxwell & Moore, Inc., Valve Div 244, 245
Marathon Electric Corp. *
Marley Co., The *
Marlo Coil Co. *
Marsh Instrument Co., Div. of Colorado Oil and Gas Corp. 33
McDonnell & Miller, Inc 23
McQuay, Inc. 29
Mercoid Corp., The 236
Mettler Div., Eclipse Fuel Engineering Co. *
Microtron Corp. *
Mid-Continent Metal Prod. Co. *
Midland-Ross Corp. 196
Midwest Piping Co., Inc. *
Miller Electric Mfg. Co., Inc. *
Miller Valve Co., Inc. 232
Mine Safety Appliances Co. 171
Minneapolis-Honeywell Regulator Co. 60, 61
Minnesota Mining & Mfg. Co. *
Miracle Adhesives Corp. 238
Missile Dynamics Corp., Air Motion Research Div. 231
Modine Mfg. Co. 172, 173
Moeller Instrument Co. *
Molco Drilling Equipment Co. 20
Monarch Mfg. Works, Inc. 254
Moore, Inc., Goodloe E. 233
Moore & Co., Samuel, Dekoron Prod. Div. *
Mueller Climatrol Div. of Worthington Corp. *
Murray Mfg. Co., D. J. *

Nash Eng. Co., The 108
National Airoil Burner Co., Inc. 81
National Exposition of Power & Mechanical Engineering 229
National Heater Co., The 37
National Supply Co., The, Tubular Products Div. 183
National Tube Div., United States Steel Corp. *
New York Blower Co., The *
Niagara Blower Co., The 228
NIBCO Inc *
Norman Products Co. *
Nordstrom Valve Div., Rockwell Mfg. Co. *

Oakite Products, Inc. *
Octagon Ventilator Co. *
Ohio Brass Co. *
Omark Industries, Inc. *
Owens-Corning Fiberglas Corp. *

Packless Metal Hose, Inc. 242
Palmer Thermometers, Inc. 238
Panelbloc Div., Bettcher Mfg. Corp. 229
Parker Boiler Mfg. Co., Sid E. *
Patterson-Kelley Co., Inc., The 73
Peerless Electric Div., H. K. Porter Co., Inc. *
Peerless Pump Div., Food Machinery and Chemical Corp. *
Penn Ventilator Co. 25
Permacel *
Phelps Dodge Copper Products Corp. 97
Philadelphia Thermometer Co. *
Phillips Cooling Tower Co. 62, 63
Pittsburgh Corning Corp. 46, 47
Pittsburgh Plate Glass Co., The Fiber Glass Division *
Porter Co., Inc., H. K., Forge & Fittings Div. *
Powell Valves 30
Powers Regulator Co. 8, 9
Precision Parts Corp. *
Presstite Div., American-Marietta Co. *

Quickdraft Company 252

Radiator Specialty Co. 256
Ramset Fastening System Winchester-Western Div., Olin Mathieson Chemical Corp. *
Ray Burner Co. *
Raybestos-Manhattan Inc., Manhattan Rubber Div. 197
Raypak Co., Inc. *
Reading Tube Corp. *
Recold Corp. *
Red Jacket Mfg. Co. *
Reed Mfg. Co. 198
Reliance Electric & Eng. Co. 50, 51
Remington Arms Co. *
Rempe Co. *
Republic Steel Corp. 26
Research Publishing Co. *
Revere Copper & Brass, Inc. *
Reznor Mfg. Co. 201
Ridge Tool Co., The 27
Riggio Co., Inc., Frank D. 255

Continued on page 264

SARCO

Here are 7 Sound Reasons Why the Thermo-Dynamic® Does a Better Job of Trapping

SARCO
Thermo-Dynamic
STEAM TRAP

1. *Simplicity*—has only one moving part. 2. *Maintenance*—practically zero. 3. *Wide pressure range*—one trap for all pressures from 10 to 600 psi. 4. *Uniform performance*—operates equally well on heavy, light, or no condensate load. 5. *Operates against back pressures*—up to 50% of inlet pressure. 6. *Rugged*—unaffected by superheat, water hammer, vibration, or corrosive condensate. 7. *Minimizes inventory* of spare parts.

Maintenance Time: 40 Seconds. If it now takes your maintenance crew more than a couple of minutes to service an ordinary trap, you're throwing away valuable time. This Sarco Thermo-Dynamic can be cleaned, blown out if necessary, and reassembled on the line in as little as 40 seconds.

For Prompt Information on the TD-50 . . . or for fast help on the efficient solution of any steam trapping problems, get in touch with a SARCO District Office, Sales Representative, or Distributor. (There's one near you.)

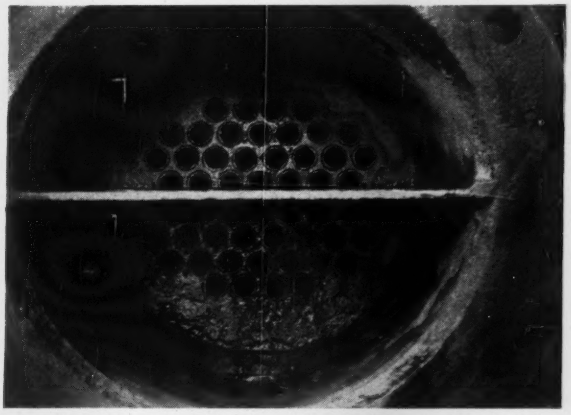
Only SARCO makes all 5 types:
Thermo-Dynamic* • Thermostatic • Liquid Expansion • Float Thermostatic • Inverted Bucket

*U.S. Pat. No. 2,817,353 TM Reg. U.S. Pat. Off.
1402

SARCO
COMPANY, INC.
635 Madison Ave., New York 22, N. Y.

Descale cooling towers, evaporative condensers, ice-making machines rapidly, effectively with **dry acid** cleaners based on **Du Pont Sulfamic Acid**

SAFER, EASIER TO USE. Dry acid cleaners eliminate hazards of handling liquids, particularly where carboys are involved. These cleaners can be added directly to sump of cooling tower or evaporative condenser . . . dissolve scale fast—destroy algae, too!



LESS CORROSIVE. For descaling condenser tubes (above) and other parts, sulfamic cleaners are less corrosive than liquid cleaners . . . on brass, 60% less; on steel, 70%; copper, 85%; aluminum, 95%. Many sulfamic cleaners can be used safely on galvanized steel.

DRY-ACID CLEANER
based on
Sulfamic Acid

LOWER HANDLING COSTS. This 100-lb. drum of dry acid cleaner is more than equivalent to this carboy of inhibited muriatic acid weighing 192 lbs. You'll save on shipping, handling and storage expenses. And no deposits because drums are disposable.

DRY-ACID CLEANER
based on
Sulfamic Acid

NON-FUMING. These dry acid cleaners produce no corrosive gases, either dry or in solution. No harmful fumes to cause corrosion in vapor spaces of equipment or damage to electrical and operating parts . . . and never a toxic fume problem to personnel.

Ask your supplier for safer, effective cleaners based on Du Pont Sulfamic Acid or mail coupon for additional information and names of formulators who offer these compounds.

NEW DRY-ACID CLEANERS
DU PONT
SULFAMIC ACID

E. I. du Pont de Nemours & Co. (Inc.)
Industrial and Biochemicals Department, N-2539-HP
Wilmington 98, Delaware.

Please send me ☐ sulfamic acid general equipment cleaning bulletin, ☐ names of formulators offering cleaners based on sulfamic acid.

*Name*________________________

*Company*________________________

*Address*________________________

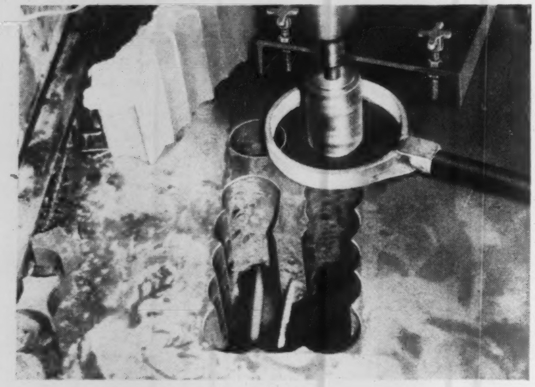
*City*________________ *Zone*______ *State*________

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

CUTTING POWER!

Clean, Even Openings in Concrete and Cast Iron



To make large square openings through a 13-inch reinforced concrete floor, a construction firm decided on a Longyear diamond drill. *All 60 holes were made with one 4-inch Longyear bit, and drilled in 6-10 minutes each.* Another contractor drilled *fifty* 2-inch holes *in cast iron pipe* with Longyear equipment and a single Longyear diamond bit. Actual drilling took only 1-2 minutes to make a clean, even hole in the 6-inch pipe. Call your Longyear dealer for more information on Longyear electric and air powered drills and bits.

Adv-170

Longyear®

E. J. LONGYEAR CO.
76 S. Eighth Street
Minneapolis 2, Minnesota
Phone: FEderal 9-7631

Please send complete information on Longyear Diamond Bits and Industrial Drills. Also the name of my nearest Longyear dealer.

NAME__________
FIRM__________
ADDRESS__________
TOWN__________ STATE__________

CHATLEFF
VECTROLE VALVE
V58
MODEL
115V
VOLTAGE
12
WATTS
CHATLEFF VALVE & MANUFACTURING CO.
P. O. BOX 96 · AUSTIN, TEXAS

SILENT SWITCHING OPERATION

NON-LIMING MOVING PARTS

FIELD SERVICEABLE

You get
INDEPENDENT UNIT CONTROL
for hot or chilled water systems with . . .

The Vectrole
Water Diverting Valve

For year 'round comfort automation at a reasonable price, the Chatleff Vectrole Valve, Switching Element and Thermostat give you a complete comfort control system at a tremendous saving.

SOLID BRASS CONSTRUCTION

For complete information, write:

CHATLEFF CONTROLS, INC.
205 Industrial Blvd., Austin 4, Texas

INDEX TO ADVERTISERS

Continued from 262

Roberts Co., C. A. 208
Roberts-Gordon Appliance Corp. 253
Robvon Backing Ring Co. *
Rockwell Co., W. S. 230
RP&C Valve Div.-American Chain & Cable Co., Inc. *

Sarco Co., Inc. 233, 239, 262
Sarcotherm Controls, Inc. 233, 239, 262
Sealmaster Bearings Div. of Stephens-Adamson Mfg. Co. *
Shaw-Perkins Mfg. Co. 223
Shuford Mills, Inc. *
Skidmore Corp. 32
Smith Corp., A. O., Electric Motor Div. *
Sonoco Products Co. 76
Southern Plastics Co. 234
Speedline Fittings Div., Horace T. Potts Co. *
Spence Engineering Co. 193
Sporlan Valve Co. 78
Squires Co., C. E. *
Sterling, Inc. *
Stoddard Industries, Inc. 210
Superior Combustion Industries, Inc. 182
Surface Combustion Div., Midland-Ross Corp. 196
Swartwout Fabricators, Inc. 200

Taco Heaters, Inc. 175
Tankit Co., Inc., The *
Taylor Instrument Cos. 249
Thermal Engineering Corp. 176
Titus Mfg. Co. *
Titusville Iron Works Co. The Div. of Struthers Wells Corp. *
Trane Co., The 56, 57
Trerice Co., The H. O. 255
Tube Turns, div. of Chemetron Corp. 18, 19
Tuthill Pump Co. *
Tuttle & Bailey Div. of Allied Thermal Corp. *

Union Carbide Chemicals Co., Div. of Union Carbide Corp. 77
Union Carbide Development Co., Div. of Union Carbide Corp. *
Union Iron Works 87
Unistrut Products Co. *
United Cork Companies *
United Sheet Metal Co., Inc. *
U. S. Air Conditioning Corp. 251
U. S. Flexible Metalic Tubing Co. 215
United States Register Co. *
United States Rubber Co. *
United States Steel Corp. *

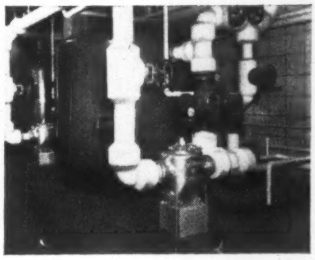
Van-Packer Co., Div. of The Flintkote Co. 177
Vapor Heating Corp. 260
Vibration Mountings, Inc. *
Vilter Mfg. Co., The 206
Vulcan Radiator Co., The 22

Wagner Electric Corp. 28
Walton Laboratories, Inc. 169
Waterloo Register Co. 195
Webster & Co., Warren *
Webster Engineering Co. *
Weil-McLain Co. 82
Weil Pump Co. 192
Weinman Pump Mfg. Co., The 74
Weirton Steel Co. 21
Welbilt Air Conditioning and Heating Corp. *
Western Boiler Co. *
Western Engineering & Mfg. Co. 250
Westinghouse Electric Corp., Apparatus Div. *
Wheatland Tube Co. 86
Wheeling Corrugating Co. 14, 15
Wiedeke Co., The Gustav 256
Will-Burt Company, The *
Williams Gauge Co. *
Wilson Engineering Co. *
Wing Mfg. Co., L. J., Div. of Aero Supply Mfg. Co., Inc. 225
Witco Chemical Co. 181
W-K-M Div. of ACF Industries, Inc. 190
Wolverine Tube Div. of Calumet & Hecla, Inc. *

Yarnall-Waring Co. 174
York Corp. *
Young Radiator Co. *
Young Regulator Co. *
Yuba Consolidated Industries, Inc. 93

Zallea Bros. *
Zurn Industries, Inc., Plumbing Products Div. *

Consulting Engineers for Baylor University Medical Center: Zumwalt & Vinther, Dallas. Architects: Thomas, Jameson & Merrill, Dallas. Plumbing Contractors: Brown & Olds Plumbing & Heating, Dallas.



High Capacity **BRUNER** Equipment Supplies Soft Water for Baylor University Medical Center, Dallas, Texas

Soft water used in laundry and dietary facilities for Baylor Medical Center's three hospitals improves the appearance of uniforms and linen, makes dishes shine, cuts soap consumption by approximately 50%. Here, and across the U. S. leading engineers specify Bruner water softeners, America's most complete line. Full information is available from Bruner Sales Offices in all major cities.

BRUNER Corporation
4767 North 32nd Street, Milwaukee 9, Wisconsin
DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.

This seal helps you guarantee unitary air-conditioning performance*

ARI STANDARD 210

Purchasers want—and deserve—assurance of satisfactory equipment performance.

The ARI Seal of Certification offers *you—and* your customers—such assurance. The Seal appears only on equipment that meets industry-approved performance standards, and that is subject to a grueling test conducted by an independent laboratory. Any model failing to deliver rated capacity must be brought up to standard or the Seal is withdrawn.

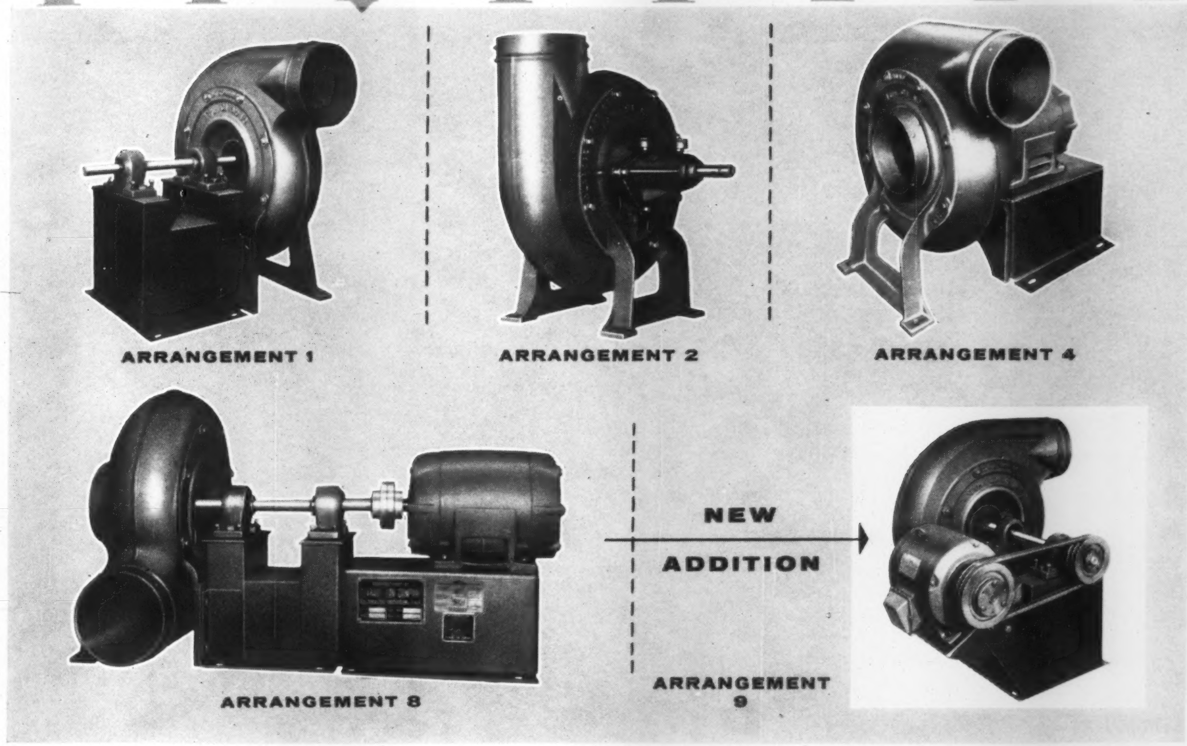
All capacity ratings are based on a uniform set of standard conditions—expressed in Btu per hour.

The 51 leading manufacturers who support the ARI program are helping you guarantee customer satisfaction. Once installed, ARI-certified equipment will deliver rated cooling. That means fewer customer complaints, fewer service calls, less repair and replacement expense.

How's that for a guarantee?

*"Unitary" air-conditioners included in this program: all packaged air-conditioners, single units or two-piece units (called "split" systems), designed to be used together, up to 135,000 Btu per hour (Btuh) in capacity, not including room air-conditioners. ARI Standard 210-58 for electrically-driven equipment; ARI Standard 250-58 for heat-powered equipment.

For free explanatory booklet and Directory of participating
manufacturers, write to: Chief Engineer, Dept. H-1105
Air-Conditioning and Refrigeration Institute
1346 Connecticut Avenue, N.W., Washington, D.C.



Presenting... the new line of CLARAGE Type CI Exhausters

Volumes to 3800 CFM, pressures to 18″, temperatures to 750°F., six sizes, three wheel types, five arrangements as shown above, adjustable to any of the eight standard air discharge directions.

Result: fan equipment uniquely well suited to nearly every service imaginable. The uncomplicated, heavy construction, featuring cast iron housings and sideplates, makes the Type CI the natural selection for such severe applications as exhausting from grinding, woodworking, and other machines . . . conveying materials ranging from fibers to grains . . . removing smoke and fumes . . . furnishing industrial process air . . . handling chemical and hot gases.

Write for new Catalog 707 containing performance tables, dimensions, and system data. Get acquainted with the advantages you'll enjoy by choosing Clarage Type CI Fans for your next requirements. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

Dependable equipment for making air your servant

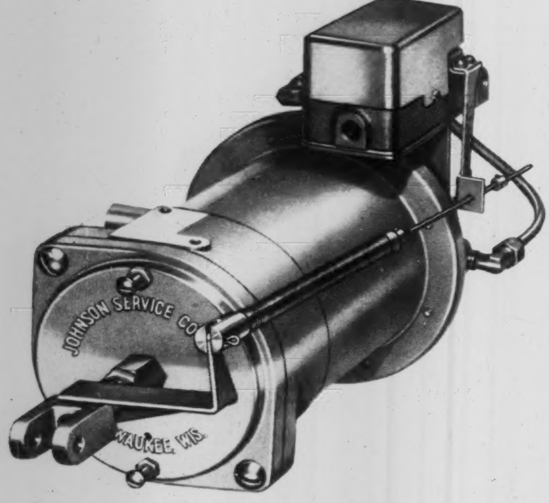
CLARAGE FAN COMPANY

Kalamazoo, Michigan

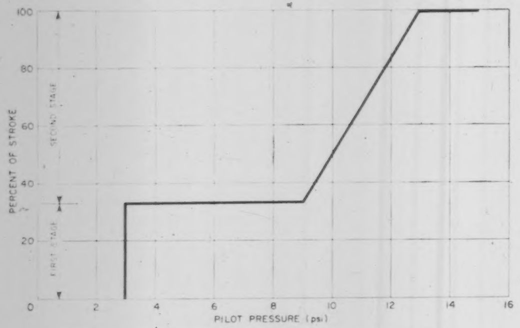
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

JOHNSON D-267 DOUBLE RANGE PILOT POSITIONER

FOR TWO-STAGE OPERATION OF UNIT VENTILATOR DAMPER OPERATORS


JOHNSON SERVICE CO.
MILWAUKEE, WIS.

D-267 DOUBLE RANGE PILOT POSITIONER
APPLIED TO No. 4 D-251 PISTON DAMPER OPERATOR



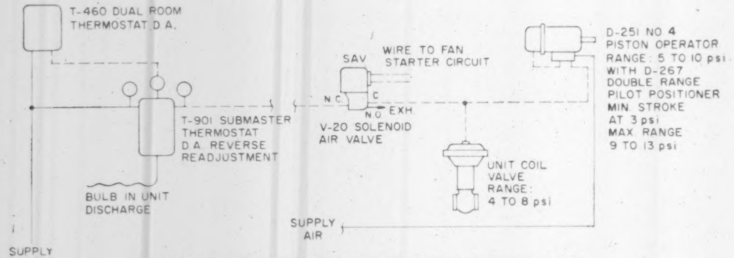
TYPICAL RELATIONSHIP BETWEEN OPERATOR
STROKE AND PILOT PRESSURE

The Johnson D-267 Double Range Pilot Positioner provides two-stage operation of piston damper operators. It is specially designed for application to schoolroom unit ventilators to meet minimum outdoor air requirements.

Features include:

- *First Stage Operation* — two-position action only. Stroke can be adjusted from 0 to 60% of total piston stroke.
- *Second Stage Operation* — proportional operation, with both starting point and operating range adjustable.
- *Accurate Control*—full control air supply pressure is used for repositioning operator at all times. Assures precise, dependable control. Pilot eliminates effects of friction, changes in air velocities, or other variables.
- *Mounting* — may be mounted in any position. Available with type "OS" or "W" mounting plates.

For complete information write for Bulletin D-267.
Johnson Service Company, Milwaukee 1, Wis.


T-460 DUAL ROOM THERMOSTAT D.A.
T-901 SUBMASTER THERMOSTAT D.A. REVERSE READJUSTMENT
BULB IN UNIT DISCHARGE
SUPPLY AIR
SAV
WIRE TO FAN STARTER CIRCUIT
N.C.
C
N.O.
EXH
V-20 SOLENOID AIR VALVE
UNIT COIL VALVE RANGE: 4 TO 8 psi
SUPPLY AIR
D-251 NO 4 PISTON OPERATOR RANGE: 5 TO 10 psi WITH D-267 DOUBLE RANGE PILOT POSITIONER MIN. STROKE AT 3 psi MAX. RANGE 9 TO 13 psi

TYPICAL APPLICATION — D-267 PILOT POSITIONER
CONTROLLING OUTDOOR AIR DAMPER IN SCHOOLROOM UNIT VENTILATOR

OUR 75TH YEAR

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885